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Korea's Policy Direction for Drone Market and Renewable Energy Sector: Focusing on O&M Industry Case Analysis

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ABSTRACT

As markets for drones have recently expanded, there is a possibility that they can be applied. Reason why drones are receiving popularity in variety of fields is because they can be controlled remotely and can operate them by attaching additional devices. Additional devices can be selected depending on the need for ultra-high-definition cameras, ultrasonic waves, deterioration sensors and GPS, as well as temperature or light sensor, oxygen and carbon dioxide density sensors. With wireless communication, the drone can measure the results of its mission such as photos or videos through various wireless communication technologies such as L Bluetooth, cellular system, Wi-Fi, and satellite communication to ground control system (GCS). Therefore, this study will need to consider the scalability of the power and environment sectors significantly in the O&M market. The expansion of the service O&M market is expected in terms of environmental monitoring and environmental protection, including the expansion of the market from fossil fuel power plants to new renewable energy sources.

Recently, the South Korean government is planning to provide various policies to create ecosystem and new growth engines for the drone industry and operate a program that supports industry activation. This policy direction is expected to be a large part of the O&M service market for solar cluster complexes in the service utilization sector. If the existing manufacturing industry builds a platform for a larger service industry, even if it lags behind China, Japan and Europe, it will be formed as an export model package and

will be enhanced into renewable energy sectors, especially in Korea's small and medium companies.

Keywords: Renewable Energy Sector, Industrial Policy, Electric Power, Environment, Korea.

I. INTRODUCTION

As markets for drones have recently expanded, there is a possibility that they can be applied. Reason why drones are receiving popularity in variety of fields is because they can be controlled remotely and can operate them by attaching additional devices. Additional devices can be selected depending on the need for ultra-high-definition cameras, ultrasonic waves, deterioration sensors and GPS, as well as temperature or light sensor, oxygen and carbon dioxide density sensors. With wireless communication, the drone can measure the results of its mission such as photos or videos through various wireless communication technologies such as L Bluetooth, cellular system, Wi-Fi, and satellite communication to ground control system (GCS).

At CES 2017, which is one of the world's home appliances exhibition, Power Vision, one of the robot companies, introduced underwater drone “powerlay” that can look for fish. This drone can dive up to 30 meters deep. It is not a wireless product, but it is connected by a boat and cable on the water and can be detected through a sonar of 40 meters of water. In addition, China's “Ehang” company displayed multi-coptor aircraft for human passengers. The name "manned drone" is used for this vehicle. The definition of drones is expanding beyond the concept of unmanned aerial vehicles to new concept aircraft capable of carrying and flying passengers. [1-2]

Based on the growth of drone technology, related markets and national policies should also be changed. In response, this research is going to explore industries that can use drones, analyze cases of the US, Japan, and Germany that have already been applied with drone operating technologies, and develop implications for activation of drone markets in South Korea.

II. GROWTH OF DRONE MARKET

Although it has been a few years since commercial drones have drawn attention from media, military drones have drawn attention since they went through wars in Afghanistan (2001) and Iraq (2003 - 2011). The background of military drones is known as the “3D (Dull, Dirty, or Dangerous)” flight mission. In other words, the 3D ① Long-time vigilance and surveillance mission ② Mission in contaminated environment such as radioactive materials ③Dangerous missions in situations where air dominance is not attained Helped change from manned aircraft to unmanned aircraft.

However, the development and operation of drones, which used to be considered as military equipment, has developed a wide range of personal hobbies, entertainment,

and commercial purposes since around 2010, leading to rapid development of related technologies. [3] Table 1 shows that drones are currently being used in a wide variety of fields.

Table 1. Function and Usage of Drones

Function	Form	Specific usage type
Report Record	Development Survey, Measurement	Mine mining, cultural property survey, land survey, agricultural land Measurement
	Maintenance of facility inspection	Inspection of road, dam, road, etc. and determination of the progress and process of building materials
	Security and surveillance	Cost of critical facilities, surveillance of illegal speculation, surveillance of suspects and terrorists, surveillance of power lines and towers in Germany, fire and traffic monitoring, etc. (Netherlands Fire Station)
	Identifying environmental preservation, disaster and agricultural information	Monitoring of the forest service, national parks, monitoring scarce animals, identifying and analyzing disasters, including landslides and typhoon damage, monitoring crops, and identifying farm crops.
	Aerial photography for entertainment, Hobby	Take and record entertainment and PR, promotional videos and photos
Transportation	Transportation	Transportation of medical, supplies and emergency supplies(DHL) Daily necessities and food delivery(Amazon.com)
	Preservation of farmland	Preservation of farmland, such as spraying of pesticides
Exercise Assistance	Rescue, Capture	The rescue of flood areas, arrest of suspects
	Energy infrastructure supply	Provides local Internet access in the air(Sky)(Google, Facebook)

Also, as shown in Fig 1, in the future, prevention activities in agriculture, video photography, and delivery will be expanded to a wider range of fields, and the O&M market will open.

Fig 1. current status of commercial drones

Therefore, this study will need to consider the scalability of the power and environment sectors significantly in the O&M market. The expansion of the service O&M market is expected in terms of environmental monitoring and environmental protection, including the expansion of the market from fossil fuel power plants to new renewable energy sources. [4]

III. CASE STUDY OF DRONE APPLICATION

Ⅲ.Ⅰ Field of Electric power

In the event of a failure of a power facility due to a natural disaster, the damage situation can be identified and the facility can be recovered quickly. In addition, it is possible to check whether or not there are any problems with power facilities using optical and thermal infrared cameras, ultrasonic wave equipment, GPS, etc. It was able to remove human resources and temporal and spatial factors that were put into inspection and inspection by using manned helicopters and enhance safety and economic feasibility of such work by using drones. A related use case is shown in Fig 2. In addition, it is also easy to select optimal location through a three-dimensional review of drone use during location of power supply site, and to check whether workers follow safety regulations, and to manage safety and quality of work place.

Inspection of the parts (optics)

Transmission tower diagnosis (thermal imaging camera)

Installation of power line wires

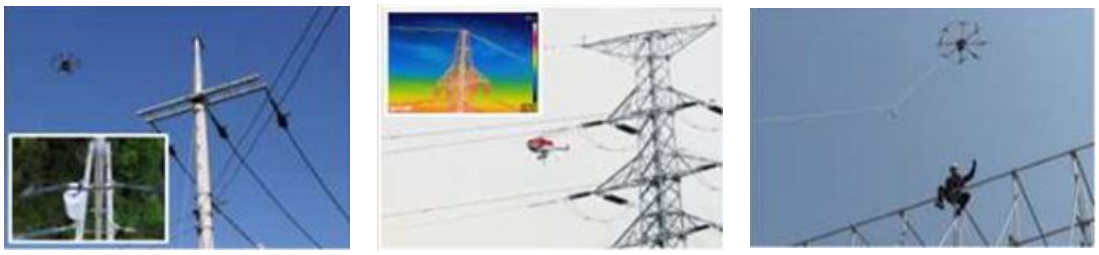

Fig 2. status of use of drones in electric power field

Ⅲ.Ⅱ Field of environment

The DRI(Desert Research Institute) in Nevada, the US., is developing drones that can be scattered in the air and have " Cloud seed " that can produce artificial rain. Before that, people had traveled by plane or by rocket. However, the advantage of drones is that they can produce artificial rain by spraying "silver iodide" exactly where they want to while drastically reducing costs. Meanwhile, instead of letting rain fall, it is also considering spraying rainwater from the roof of high-rise buildings. It is to reduce fine dust by spraying it with water. This method is as cheap and environmentally friendly as using raindrops. This allows fine dust to stick to water in the same way that dust sticks to the surface of a balloon. Recently, it is also researching how to remove fine dust by using drones. The U.S. journal Science once introduced a plan to remove fine dust by blowing off hundreds of drones equipped with fine dust filter. In order for drones to carry out their duties while charging frequently, they are going to install a heat balloon type drone charging station in the air and hold it for a long time to remove fine dust. [5]

IV. APPLICATION OF DRONE TO RENEWABLE ENERGY O&M INDUSTRY

IV. Ⅰ America

U.S. start-up company called Scanifly evaluated (Device, method, apparatus, and computer-readable, medium for solar site assessments, US20160004795) candidate sites for solar power generation by using drones in January of last year. This patent describes how to use drones to evaluate accurate and efficient points of installation of solar energy.

Evaluation of solar power installation location can be seen as a process of collecting related data by measuring location of different points to install solar panels that produce solar energy. As shown in Fig 3, the drone will scan the location just below the drone through a three-dimensional sensor and collect images of the movement of the sun through the lens.

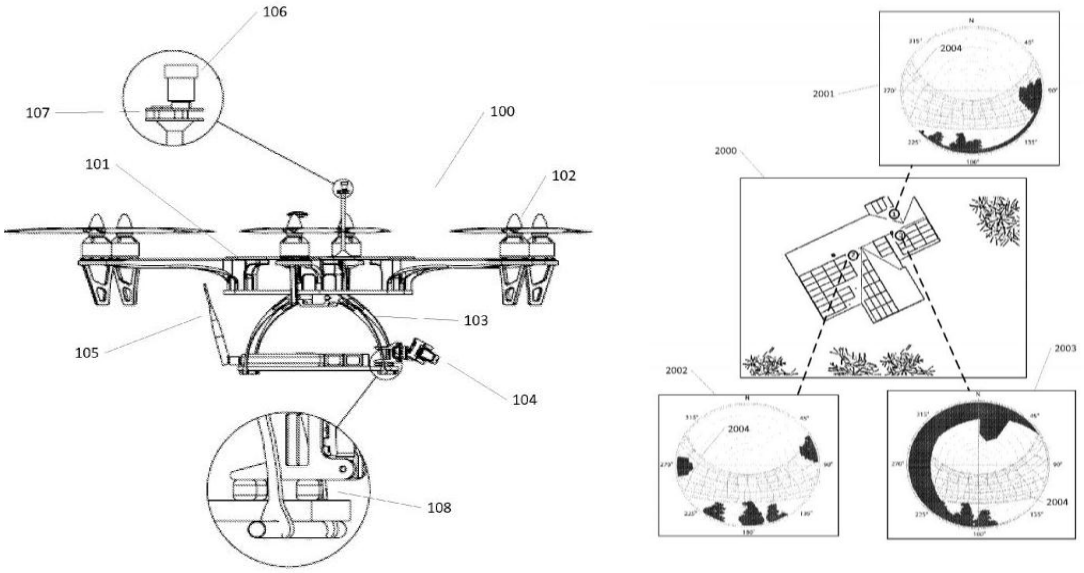

Fig 3. side view of the drone

The data is transmitted through the transceiver attached to the drone and ordered from outside. Using this collected data, a three-dimensional model of ' hemispherical view shade ' is created. The Sun moves in a hemispherical motion from east to west, which is an area visible from one point. Thus, hemispherical view ships should be considered, such as mountains and trees. Therefore, when a hemispherical view shade is created at each point, it selects the best spot for lighting during the day. [6-7]

In 2014, British Petroleum (BP), a British oil company, was first approved for commercial use of drones in the U.S. The U.S. Federal Aviation Administration (FAA) accepted BP's request that drones can be used to conduct oil exploration in Alaska. So far, the FAA has strictly banned the commercial use of drones. With FAA approval, BP was able to use drones made by the drone manufacturer "Aero Varianment" company to conduct oil exploration and oil pipeline inspection in the Prudo Bay oil field in Alaska. This also laid the foundation for Alaska's oil industry. Alaska has an average temperature of – 27°C, which makes it difficult for people to conduct oil exploration or inspect its pipeline. By using drones, it is predicted that they will be able to secure safety, protect environment, and improve productivity.

IV. Ⅱ Japan

Yonezawa Electric Corporation, which is a Japanese electricity manufacturer, is developing a system that uses drones to diagnose solar panel faults. This system measures temperature of solar panels by flying drones that are equipped with infrared cameras, and analyzes big data on heat images to accurately distinguish areas that have problems. Because measuring instrument does not come into direct contact with

panels, inspection is possible even when solar cells are running. For solar facilities with a power generation of 50 kW, measurements can be made in about 10 minutes. Therefore, it is currently researching on optimal height of drones and angle of shooting.

In early 2017, Sharp, a Japanese company, developed ' Automatic Design Technology for Using Drones. That can reduce cost of constructing large solar power plants. It is a technology that automatically creates 3D maps by flying over construction areas of solar power plants and automatically creates designs based on drones. This year, the price of solar power generation higher than 10kW has dropped by half from five years ago, which requires a reduction in the construction cost of Mega Solar. Sharp is not only selling solar panels, but also pushing forward with Mega Solar's EPC (Design, Procurement, and Construction) business. The percentage of material (except panel) construction costs in the initial costs of the Mega Solar project accounts for about 50 %. In order to increase profitability in these environments, reducing construction costs, including design, is essential.

Sharp's technology is to automatically produce designs with solar panels by importing 3D maps based on images of drones into CAD. In addition, the installation interval can be adjusted to prevent shadow contact between neighboring panels, and cable length and wiring can be automatically set depending on the terrain, arrangement of panels, and location of power control devices. A longer cable increases the power lost during transmission, and manually designing the length and wiring of the cable takes a lot of time to adjust the wiring. Sharp has also developed a structure that incorporates solar panels and a pillar, and it is expected that it will minimize construction of solar panels since it can change angles depending on slope. In Japan, Mega Solar is often installed on an incline, contributing to the increase in construction cost. [8]

Meanwhile, in Japan, the development of Mega Solar has been widespread since the Fukushima nuclear power plant crisis in 2011, and the related market is evolving as more companies want to participate in the O&M(Operation & maintenance) field. If drones are launched, it will be able to quickly identify problems at solar power plants. Furthermore, it is reported that water use decreases by 80 % compared to the previous usage of automatic vacuum cleaners for solar energy.

IV. Ⅲ Germany

Germany has been using drones with infrared cameras to detect panels that are defective at solar power plants for many years. Wind plants are also using drones with HD cameras, which are faster and cheaper than humans, to detect cracks. Besides these drones, they are also used to inspect bridges, dams, and towers, and they are also equipped with laser technology that can check surface of certain aircraft such as “Easyjet”. As of April 2017, there are 400,000 drones in Germany, and 20 % of them are being used for commercial purposes. The number is expected to triple in the next three years. Considering the amount of profit from each field that is related to drones

in Germany, social infrastructure and construction industries including inspection of solar panels are seen to be 34 %(Five billion dollars) and have the highest growth potential.

V. CONCLUSION-ENTRY THROUGH ODA PROJECT

Recently, drone donation and training programs are under way for two years starting this year as part of the ODA project between Korea and Mongolia. In particular, Mongolia's Minister of Natural Environment, Green Development and Tourism, expects Korean companies to advance into the environment and tourism industry by using drones. As such, it is easy for domestic companies to advance into overseas markets through the construction of platforms in the development of solar energy service packages for large-scale complexes in countries where government regulations, technological development and operational capabilities are significantly reduced.

Therefore, a stable strategy for entering foreign countries will be needed in the early stages through ODA projects. In addition, the proposal and cooperation of O&M services for large solar clusters in Africa through cooperation with the African Development Bank is considered one of the new frontier markets for drones and solar energy maintenance companies in Korea.

Recently, the South Korean government is planning to provide various policies to create ecosystem and new growth engines for the drone industry and operate a program that supports industry activation. If we look at detailed strategic items, first of all, it is going to promote supply of drones by state and public organizations and provide services through leading organizations such as land survey and facility diagnosis. In addition, it is also going to induce growth of public markets such as business establishment support, financial and tax support, and drone ODA. In addition, it is planning to establish a public and private virtuous circle structure such as new technologies, an out-of-regulation challenge project (pilot project 2.0), establishment and operation of private and public consultative by public sector, and providing incentives when using drones.

This policy direction is expected to be a large part of the O&M service market for solar cluster complexes in the service utilization sector. If the existing manufacturing industry builds a platform for a larger service industry, even if it lags behind China, Japan and Europe, it will be formed as an export model package and will be enhanced into renewable energy sectors, especially in Korea's small and medium companies. Therefore, it is possible to secure track records for overseas market advancement through policies that support expansion of service area of government and expansion of pilot business for existing solar energy platform and to lead overseas market through program stabilization.

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