

## E Contributing to the Environment to Make a Decarbonized Society and Recycling-based

### Provision of Safe and Secure Living Spaces through a Combination of Next-generation Wind Turbines and Satellite Communication Services

In a partnership with Challenergy Inc., a company known for typhoon power generation, SKY Perfect JSAT is conducting collaborative activities aimed at operationalizing services that combine stable wind power generation with satellite communications in digitally divided areas of the world, such as Southeast Asia and Pacific island countries, where both power generation and communications infrastructure are underdeveloped.

The Magnus Vertical Axis Wind Turbine that Challenergy is currently developing has excellent environmental flexibility, with fewer environmental concerns in terms of noise pollution and bird strikes than conventional propeller-type wind turbines, and the capacity to achieve stable power generation both during favorable weather conditions and when there are typhoon-level winds or turbulence.

Satellite communication offers the advantage of providing high-level communications service to digitally divided regions, such as remote islands and mountainous regions, and disaster recovery communication platforms for use after a large-scale disaster. This is expected to be the first technology in the world to succeed in harnessing electric power and communication to help the people living in these areas achieve a more modern way of life, instead of using unstable diesel power generation infrastructure, which is expensive and places a greater burden on the environment.

In summer 2021, we completed construction of the first wind turbine in the province of Batanes, an archipelago province in the northern Philippines, and we will start service that simultaneously provides wind power generation and satellite broadband communications. Batanes is an area that sustains

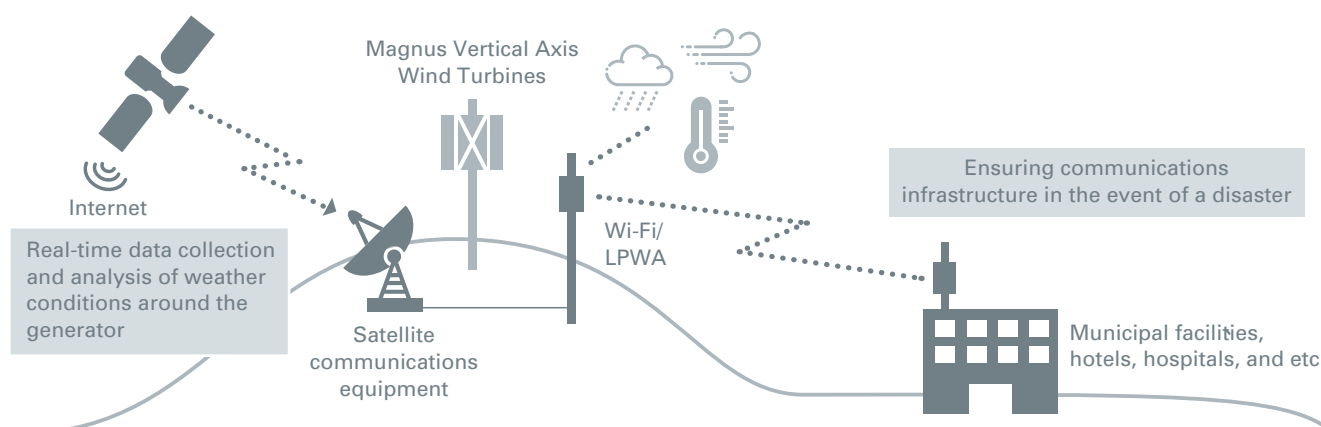


damage from typhoons nearly every year, making it difficult to install propeller-type wind turbines and solar panels that cannot withstand strong winds. Batanes also has inadequate communications infrastructure due to the remote location of the islands, raising issues specific to COVID-19, such as lack of bandwidth for school online classes.

This wind turbine is the first model to combine Challenergy's typhoon power generation and SKY Perfect JSAT's satellite communications as a solution to the social issues faced on remote islands. We will continue to provide services that live up to the high expectations of the local community. Following on from the first wind turbine, we are considering building two or more units in the Philippines after the next fiscal year.

In the future, we will use power and communications to collect, accumulate, and analyze operating and meteorological data from the wind turbines and integrate this information with satellite imagery and data from other applications. Accordingly, we will expand our business into new domains, including meteorological businesses, measures for adapting to climate change, and microgrids for local production and local consumption of energy, while actively working toward the achievement of the SDGs.

Image of a Joint demonstration project to connect a SKY Perfect JSAT satellite communication system to Challenergy wind turbines



## Economy a Reality



### Creating Methods for Forecasting Solar Power Generation Output

SKY Perfect JSAT and the Central Research Institute of Electric Power Industry (CRIEPI) are conducting joint research on a Hybrid Solar Power Generation Output Prediction System utilizing AI, satellite images, and the whole-sky images retrieved by integrated ground sensors.

Looking ahead to a decarbonized society, renewable energy is expected to become a major power source. The adoption of solar power generation has been rapidly increasing, and future expansion of its use is attracting attention. Because the output of solar power generation greatly fluctuates with changes in the weather and cloud coverage, the need for high-precision prediction is one of the important issues concerning stable supply of electricity.

SKY Perfect JSAT has been developing the KMOMY AI system for analyzing clouds since 2017, which has a cloud recognition precision of 85% or higher. Moreover, SKY Perfect JSAT developed the system for short-term solar radiation prediction by applying the technology of KMOMY. Tracking cloud movement from cloud images retrieved from both space (via satellite) and the ground (via integrated ground sensors) will improve the precision of solar power generation output prediction from several minutes to one hour in the future, which was technically difficult to achieve previously. By combining the technologies of the SoRaFAS system developed by CRIEPI to predict/analyze solar radiation via satellite images, and the short-term prediction system developed by SKY Perfect JSAT that consists of integrated ground sensors, whole-sky image analysis and AI. CRIEPI and SKY Perfect JSAT plan to systemize this technology and start a solar power generation output prediction service with enhanced short-term prediction in 2022.



#### Soratamago, IoT device

Soratamago sends cloud images and meteorological data to short-term solar radiation prediction AI. It is equipped with a celestial camera, thermometer, hygrometer, barometer, and communication devices. Designed with home solar power generation in mind, it is attractive but also simple enough for attaching to the pole of the parabolic antenna of SKY PerfectTV!



Members: (from left) Kazuya Nemoto, Sanae Takenoshita, Hiroki Obuchi (project leader), Yasuhiko Kano, Yukiya Hanada

## E Improving the environment in space



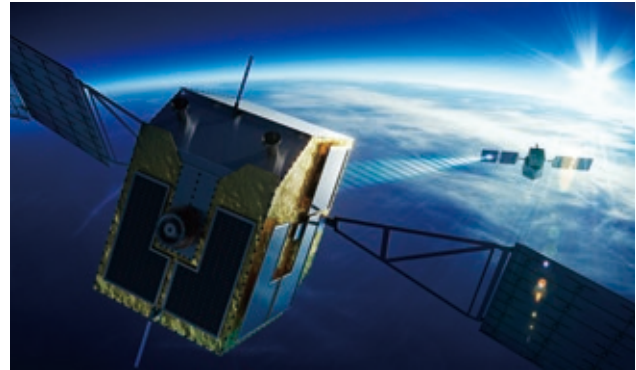
### Designing and Developing the World's First Satellite for Removing Space Debris with a Laser

SKY Perfect JSAT has partnered with the RIKEN, JAXA, Nagoya University and Kyushu University to start the design and development of the world's first satellite that uses a laser to remove space debris.

This project aiming to maintain a sustainable space environment was implemented under an internal start-up program and preliminary study of potential next-generation businesses started in 2018. Through industry-academia collaboration, the feasibility of the project has been researched and examined.

Satellites have been contributing to a safe society and a comfortable life by means of information from space in diverse forms such as weather forecasts, satellite communications, and GPS position information. On the other hand, the number of satellites that are no longer used or no longer functional, rocket parts that were used for launches, and fragments have continued to increase at an accelerating rate. If such debris collides with a satellite in use, the collision may cause trouble or damage the satellite.

This approach involves the application of laser irradiation



to space debris, such as nonfunctional satellites, from a distance, which gradually "nudges" the debris toward the atmosphere. When those debris enter the atmosphere, most will burn up while descending, and that enables removal of space debris. The laser method is safe because there is no physical contact. It is not necessary for the laser satellite to carry fuel for moving the space debris, making this method highly economical. Services are scheduled to begin in 2026.

### Environmental data

#### Energy consumption

(SKY Perfect JSAT Corporation only)

	FY2016	FY2017	FY2018	FY2019	FY2020
Energy consumption (GJ)	251,354	246,317	268,740	266,375	245,915
GHG emissions (Scope 1) (t-CO <sub>2</sub> )	10	8	10	10	8
GHG emissions (Scope 2) (t-CO <sub>2</sub> )	12,665	12,200	12,974	12,672	11,415

Scope 1: Greenhouse gas (GHG) emissions released directly to the atmosphere at the GHG emissions source

Scope 2: CO<sub>2</sub> emissions from electricity purchased from a third party, electricity generated from heat, and the heat generation stage

(Basic Guidelines on Accounting for Greenhouse Gas Emissions throughout the Supply Chain (Ministry of the Environment/Ministry of Economy, Trade and Industry))

GJ (gigajoule: unit of energy), t-CO<sub>2</sub> (tonne weight: weight indication for the amount of energy used converted on a CO<sub>2</sub> basis)

#### Total waste and other emissions (tonnes)

(SKY Perfect JSAT Corporation only)

	Akasaka Head Office*	TMC	YSCC	SPE	SPW	Total
FY2020	28.653	13.7	11.10	0.98	0.02	54.453

\*Waste emissions from head office activities

SKY PerfecTV! / Tokyo Media Center : TMC / Yokohama Satellite Control Center : YSCC / Space Port East : SPE / Space Port West : SPW