

Inspection of Photovoltaic Power Plant Using Multicopter

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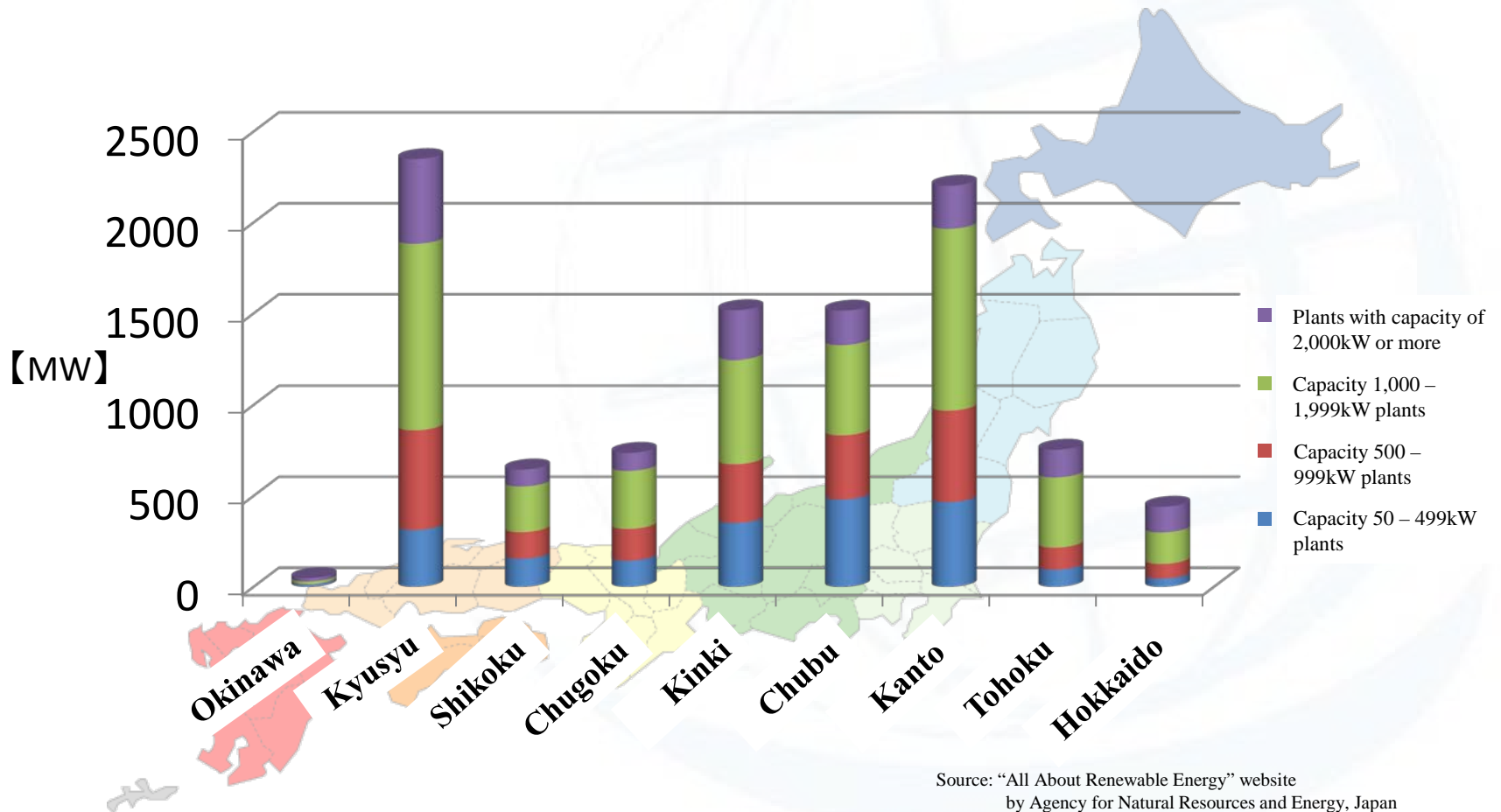
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A large, faint, light blue globe with a grid of latitude and longitude lines is centered in the background of the slide.

I. Current state of photovoltaic power plants operating in Japan

Accumulated capacity of photovoltaic power plants by region

(Regional breakdown of total amount of electricity generated by existing photovoltaic power plants)



Source: "All About Renewable Energy" website
 by Agency for Natural Resources and Energy, Japan
http://www.fit.go.jp/statistics/public_sp.html

2MW-class photovoltaic power plant

- Issue to be resolved:

Needs to inspect many panels



Requires substantial labor and time.



II. Inspection method using multicopter

Overview of multicopter inspection

- A multicopter carrying an infrared camera flies at 50 – 80 m altitude above the premises of the power plant to take infrared photographs or video.



Flight of multicopter

➤ Fully automated flight

All the flight processes, from takeoff to landing, are fully automated to let the multicopter fly required routes predefined on a PC map.

The multicopter receives GPS signals every minute to verify its position while performing posture control by using its IMU (inertial measurement unit) and main controller to keep flying at the predefined altitude and speed.



Advantage of automatic flight

➤ Problem in manually-controlled flight

The multicopter becomes less and less visible when it flies farther away from the operator. As a result, it becomes difficult to maintain consistent altitude, speed and flight course.



Automatic flight enables the multicopter to:

Fly over the vast premises stably and consistently.





III. Examples of inspection findings

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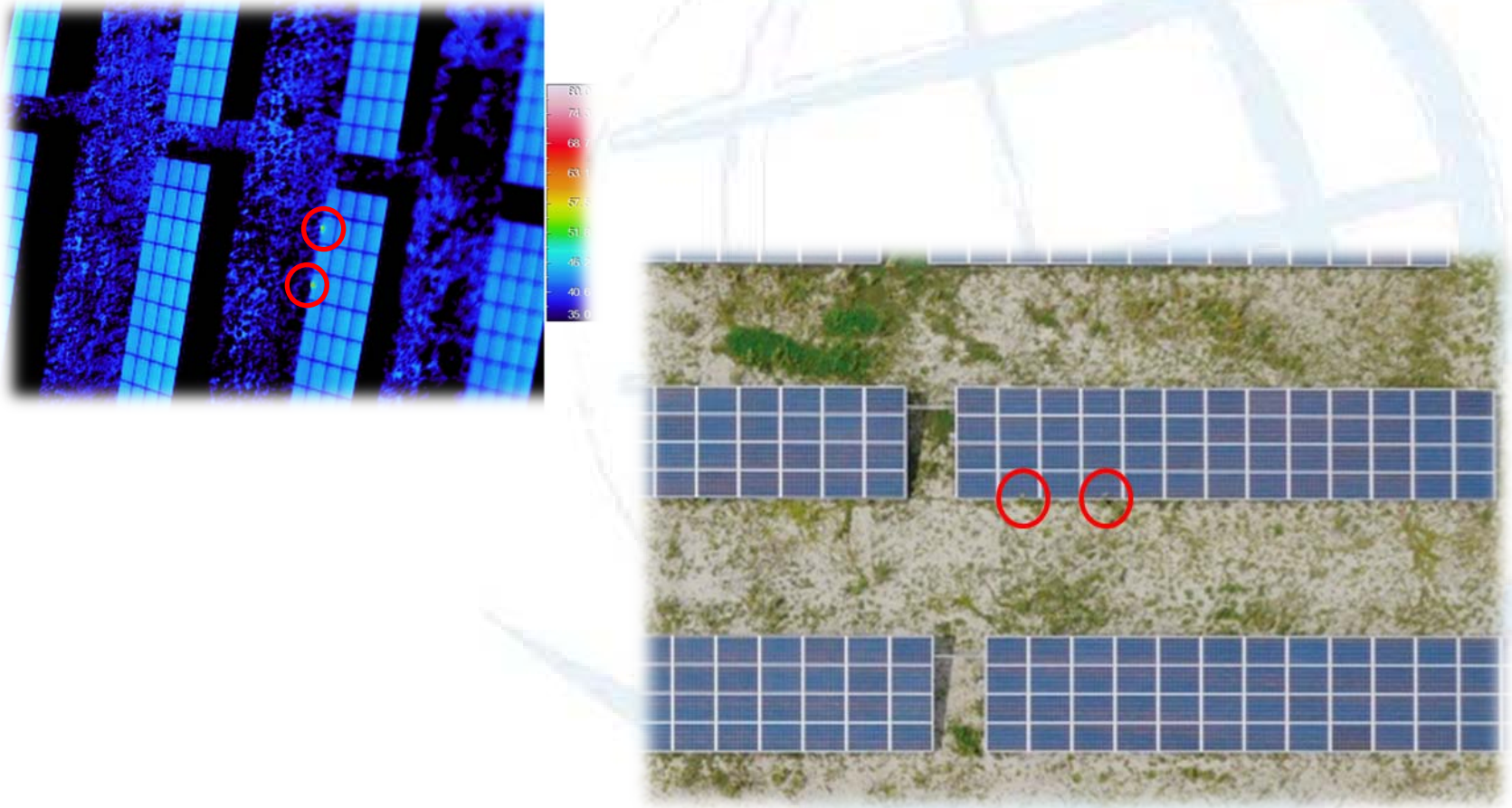


Panoramic photograph taken by multicopter from 150m altitude

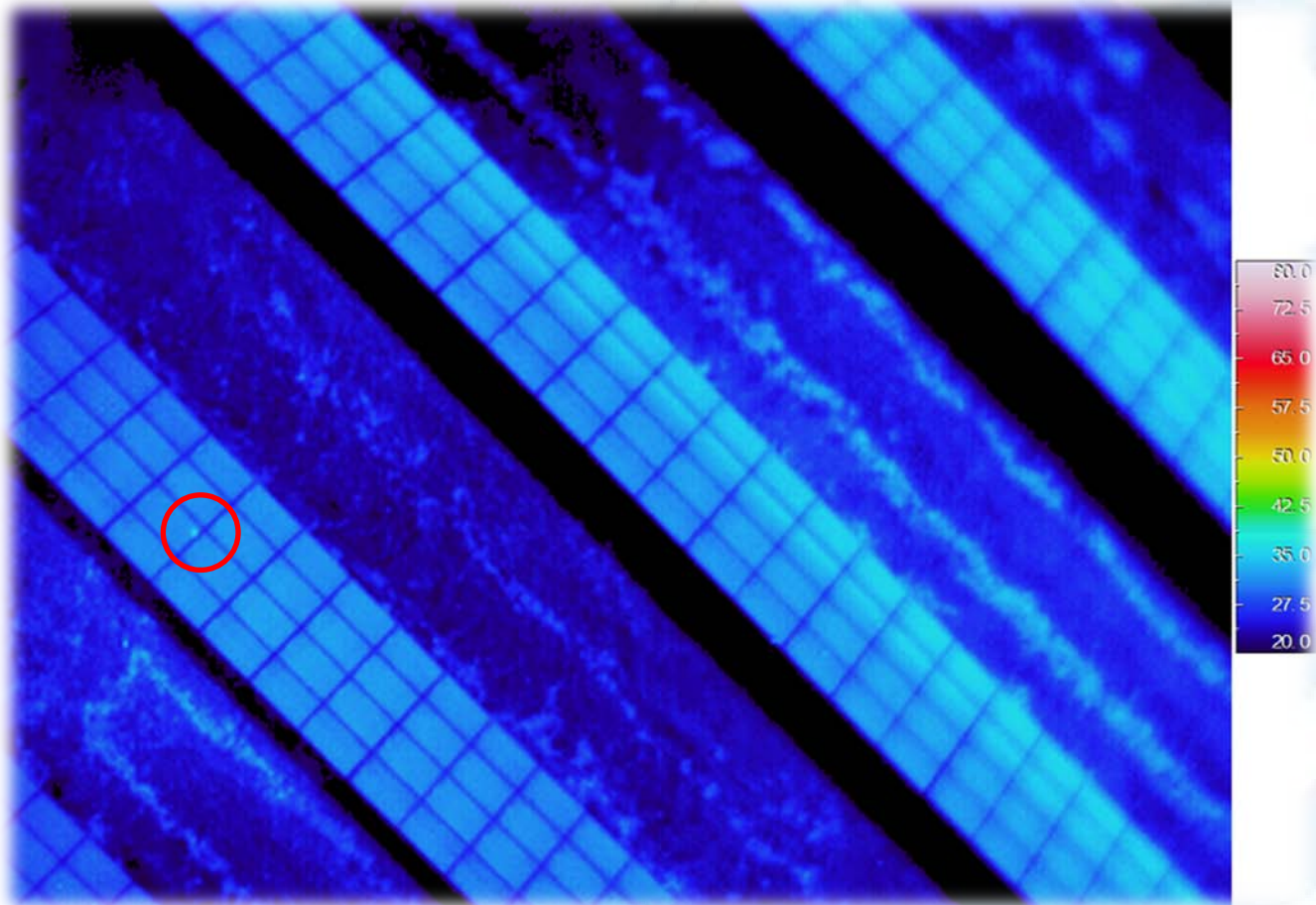
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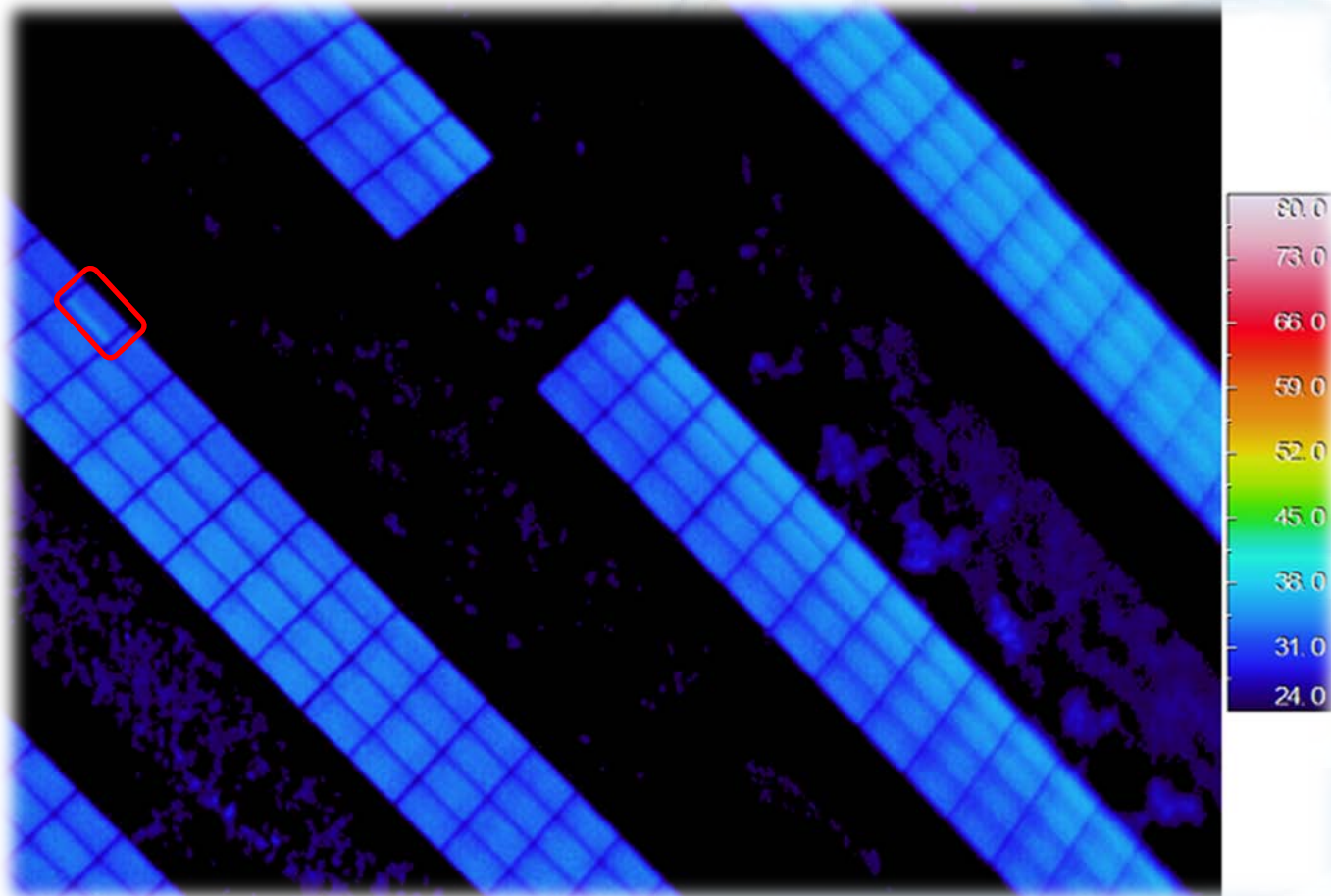
Case 1: Hot spots made by shadows of weeds



Case 2: Two-degree temperature difference detected



Case 3: Temperature difference caused by non-performing cluster



A large, light blue, semi-transparent globe with a grid of latitude and longitude lines, serving as a background for the central text.

IV. Summary

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- Effectiveness of diagnoses/inspection
Effective outcomes have been obtained and experience accumulated steadily from the infrared diagnostic imaging using multicopters.
- Need to conduct diagnoses/inspection
The power plants need diagnoses/inspection because they operate under severe environment exposed to snow in winter.

Diagnoses/inspection should be conducted periodically, to enable early detection of deterioration, malfunction and other troubles.
- Expansivity/versatility
This method can potentially be applied to a wide range of business areas, not only to photovoltaic power plants.
Currently its applicability is being tested and put into practice accordingly.

➤ Practice of the method

Hokkaido Electrical Safety Services Foundation has defined conditions and requirements and established strict rules concerning use of multicopters and power-operated helicopters, and is practicing them to ensure safe flight.

➤ Flight experience

As of today our multicopter has flown about 120 times including test/familiarization flights, and there has been no fall accident so far.

➤ Future issues/tasks

- Prepare appropriate flight conditions under winter environment
- Monitor the latest trend in safety measures, regulations on operators, etc.

We will continue to make further validation of the method and practice it accordingly to ensure safe operation.

THANK YOU

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