DRONE-BASED INSPECTION IN A GEOTHERMAL PLANT

Engery Development Corporation, the largest vertically integrated energy provider in the world

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EDC boasts a diverse portfolio exclusively centered on renewable energy sources. Primarily, the company leverages geothermal energy, abundant in various regions of the Philippines including Albay, Sorsogon, Leyte, Southern Negros, and Mindanao. Furthermore, EDC plans to introduce hydropower in Nueva Ecija, wind power in Ilocos Norte, and solar energy projects in Panay Island and Ilocos Norte. In addition to these ambitious projects, EDC is committed to integrating cutting-edge technology and sustainable practices to maximize efficiency and minimize environmental impact.

The Energy Development Corporation (EDC) in the Philippines is significantly advancing its geothermal capabilities through various technological innovations and strategic projects.

Continous Expansion

EDC is set to operationalize four new geothermal power plants in 2024, adding a total of 82 MW to the grid. These include the 29-MW Palayan Bayan binary power plant in Bicol, the 5.6-MW plant in Bago City, the 20-MW Tanawon geothermal plant in Bicol, and the 28-MW Mahanagdong binary plant in Leyte

EDC's Inspection Process Prior to DJI Enterprise Drones Deployment

Initial Assessment
The first step in their inspection process is a thorough manual walkthrough of the site. This involves a comprehensive assessment to identify potential hazards and understand the overall environment.

Documentation
During the walkthrough, detailed documentation is maintained. This includes written observations, gas and temperature reading, photographs, and notes. This thorough record-keeping not only aids in planning but also serves as a valuable reference for future operations

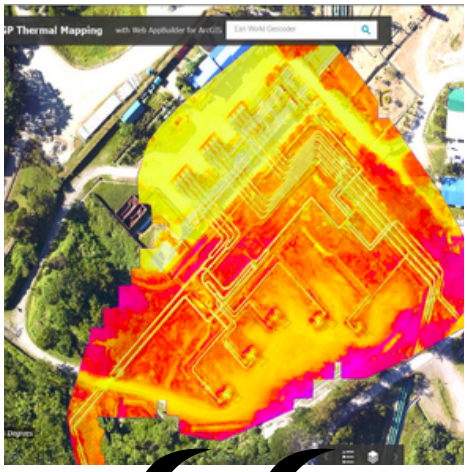
Handheld Thermal Camera Inspection
Following the manual walkthrough, their team employs handheld thermal cameras to scan critical areas. This step is essential for identifying temperature anomalies that could indicate underlying issues such as electrical problems or overheating equipment.

Analysis
The thermal images captured are analyzed meticulously to identify any irregularities. Findings are documented with thermal images, highlighting areas that require further investigation or immediate attention. This proactive approach ensures that all potential risks are identified and addressed before drone deployment.

Hazards Faced by Energy Development Corporation Personnel During Manual Thermal Inspections at Geothermal Plants

Exposure to Hydrogen Sulfide (H2S) Gas
Hydrogen sulfide (H2S) gas, a highly toxic substance commonly found in geothermal plant settings, poses considerable health dangers to individuals during manual inspections. Inhalation of H2S can result in severe respiratory problems, headaches, and, in extreme cases, fatalities when exposure levels are high.

Moreover manual inspections typically entail physically strenuous duties that increase the likelihood of accidents and injuries, particularly in demanding and rugged terrains. Geothermal facilities often have inspection sites located in hazardous areas like cliffs or elevated platforms.

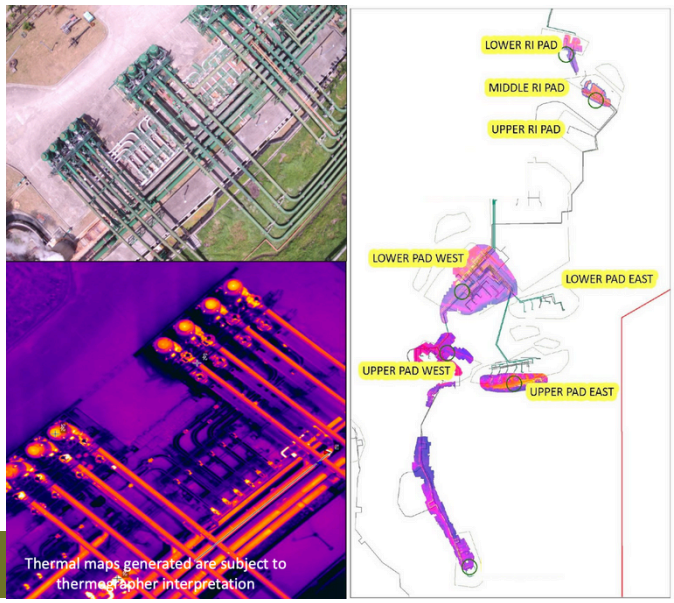


Doing manual inspection would take us years, while for drone we can do it in days

The integration of drone technology within EDC's operations serves to boost efficiency and prioritize worker safety. This implementation is crucial as the fluid collection and recycling systems (FCRS) and steam lines necessitate routine maintenance owing to the geothermal activities. Previously, these tasks relied on manual inspections, consuming significant time, particularly due to labor-intensive processes and exposure to hazardous conditions.

By deploying drones, EDC can now perform detailed inspections remotely, capturing high-resolution thermal images and real-time data without putting workers at risk. These drones are equipped with advanced sensors and thermal imaging capabilities, allowing for the early detection of potential issues such as leaks, corrosion, or overheating, thereby mitigating risks before they escalate into serious problems.

Furthermore, the data collected by the drones can be integrated into EDC’s predictive maintenance systems. This enables a more proactive approach, where maintenance schedules are optimized based on actual equipment conditions rather than fixed intervals. As a result, downtime is minimized, and the longevity of the infrastructure is enhanced.



EDC Applications for Drone Technology

Steamfield Monitoring: Utilizing drones equipped with thermal cameras for routine inspections of FCRS insulation and cladding integrity enables the detection of abnormal temperatures, potentially signaling underlying issues.

Geoscience Exploration: These drones play a pivotal role in supporting The Geoscience Group (3G) by monitoring survey progress, analyzing thermal areas, and assessing survey sites, facilitating efficient data collection from remote and challenging terrains.

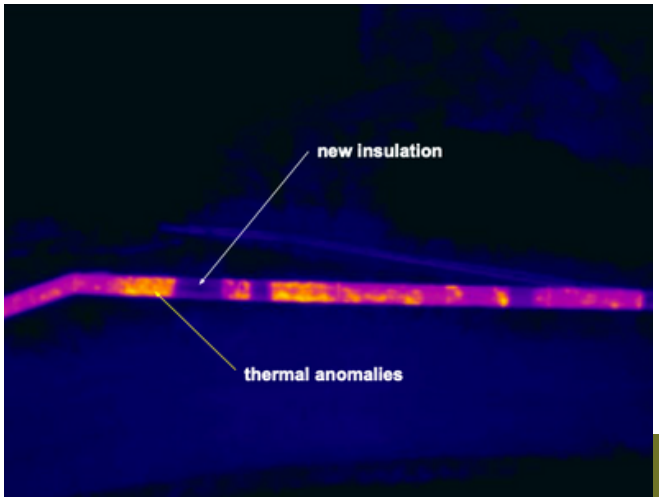
Geohazard Assessment: Conducting post-disaster evaluations and regular drone surveys aids in monitoring geohazard-related events, contributing significantly to ensuring the stability and safety of EDC project sites.

Asset Security Protection:
To improve security measures at EDC installations, drones are used for routine security patrols. Apart from enhancing general safety measures, this reduces chances of unwanted entry.

Infrastructure Maintenance: In addition to their other applications, drones are invaluable for inspecting infrastructure such as pipelines, bridges, and power lines. Their ability to access hard-to-reach areas without endangering human lives makes them ideal for identifying wear and tear, corrosion, or structural weaknesses. This timely detection prevents costly repairs and enhances the longevity and safety of critical infrastructure.

Public Safety and Emergency Response: In times of crisis, drones are indispensable tools for first responders. They provide real-time aerial footage of disaster zones, helping to coordinate rescue missions, deliver medical supplies, and assess damage. This rapid deployment capability ensures a swift and effective response, potentially saving lives and minimizing harm.

Research and Innovation: The versatility of drones extends to various research fields, from atmospheric studies to archaeological surveys. By enabling scientists to gather data from otherwise inaccessible locations, drones push the boundaries of knowledge and drive innovation across multiple disciplines. Their use in research not only broadens our understanding but also inspires new technological advancements.



Future improvements and Dock 2 Integration

In early July 2024, Energy Development Corporation (EDC) conducted a Proof of Concept (POC) at their Bacon-Manito Geothermal Facility this was led by led by Aime Loren Malabanan, DJI Certified Technical Solutions and Delivery Engineer and Capt. Xavier Catan. This initiative highlighted the significance of employing an autonomous drone capable of operating safely at a distance from potential hazards such as H2S Gas and other physical obstacles. Concurrently, a team based in Singapore oversaw the drone's flight through DJI Flighthub 2, underscoring the managerial need for real-time monitoring of both facility conditions and drone activities.

During a test flight amid heavy rainfall, Dock 2 demonstrated its resilience in adverse weather conditions, validating its capacity to function effectively in harsh environments. Furthermore, the drone was utilized for nighttime security patrols, showcasing its versatility in operational scenarios. EDC intends to outfit all its plants with a minimum of two Dock 2 units each, emphasizing a strategic implementation of this technology across their facilities.

This forward-thinking approach by EDC not only underscores their commitment to technological innovation but also enhances the safety and efficiency of their operations. By integrating autonomous drones into their regular maintenance and security protocols, EDC is setting a new standard for the energy sector.

Moreover, the data collected from these drones will be invaluable. Advanced sensors and cameras equipped on Dock 2 can provide high-resolution images and real-time analytics, enabling EDC to identify potential issues before they escalate into significant problems. This proactive maintenance strategy could lead to reduced downtime and lower operational costs, ultimately benefiting both the company and its stakeholders.

The success of the Proof of Concept at the Bacon-Manito Geothermal Facility serves as a robust foundation for future expansions. EDC's strategic plan to deploy multiple Dock 2 units across all its plants will likely inspire other companies in the energy sector to explore similar technological advancements.

As EDC continues to innovate and adapt to the changing landscape of energy production and management, their use of autonomous drones could pave the way for new industry standards and best practices. This initiative not only highlights the potential of drone technology in industrial applications but also reaffirms EDC's role as a leader in sustainable and efficient energy development.