



The Power of Outage Alerts

A simple digital health solution can *eliminate* deadly hospital blackouts — and user demand is already high

EXECUTIVE SUMMARY

- Hospital workers in LMICs are forced to cope with unreliable power and frequent power outages.
- Nexleaf, PagerDuty, the Kenya Ministry of Health, and CPHD piloted automated power status alerts to hospital workers and administrators.
- Users responded to alerts with timely actions that drove systemic power management improvements.
- **Alerts helped users prevent deadly blackouts and shorten the duration of grid power outages.**
- Users requested the technology back after the pilot period ended.

BACKGROUND: THE BURDEN OF HOSPITAL BLACKOUTS

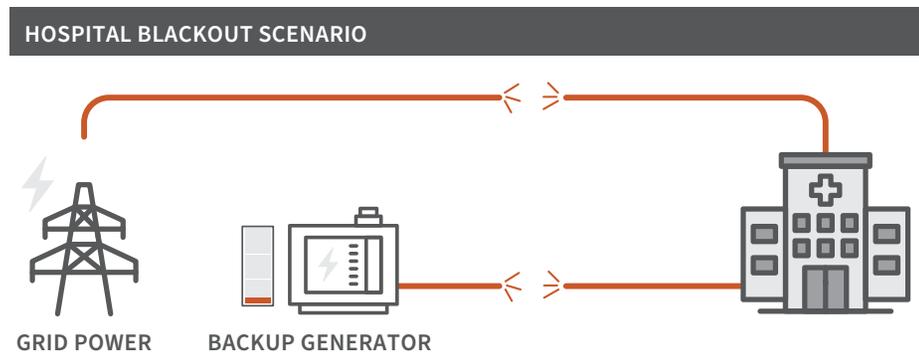
Electricity is required to treat patients and save lives. In many low- and middle-income countries (LMICs), however, grid power is unstable and can fail at any time, so hospitals rely on diesel-fueled generators to keep things running. But backup generators fail too — and when a full blackout occurs, lives are at stake.

A Problem of Never Knowing: Frequent Grid Outages Strain Generator Management

Grid power outages cause problems, even when generators kick in just fine. That's because grid outages happen often, and the only way for hospital staff to know when the generator is running is to go and check on it. Thus, they are often unaware a grid outage has occurred until the generator runs completely out of fuel, causing a dangerous blackout.

"You know it can cause death—it has actually caused death. Let's say [there is] an operation in theater. And you don't know that you had little fuel left, and your generator sucks in air. Even if you rush to the petrol station and collect fuel, you will have to remove that airlock which takes time and the patient is on the table... which could lead to the patient dying for no reason."

- Biomedical Engineer



BIOMED BIOMEDICAL ENGINEER

- Keep electricity flowing
- Manage generator
- Liaise with power company
- Maintain & repair medical equipment



MEDSUP MEDICAL SUPERINTENDENT

- Hospital administration
- Operation
- Budget
- Patient care
- Patient outcomes

The most catastrophic potential result of a hospital blackout is loss of life. But never knowing when the grid goes out is a general source of frustration and difficulty for BioMeds, who are constantly reacting to generator problems. The lack of outage information also causes administrative headaches for MedSups, fostering a sense of tension and mistrust among staff—especially when it comes to diesel fuel procurement.

"[W]hen we had to run 24 hours on a generator, we used around 200 liters of diesel...[That costs] around 32,400 shillings." - Medical Superintendent

That's roughly \$240 USD, a daunting sum for a resource-constrained hospital. The unpredictability of grid power outages makes budgeting for diesel fuel near impossible and leaves MedSups struggling to cope with runaway costs that must be paid in cash at the petrol station.

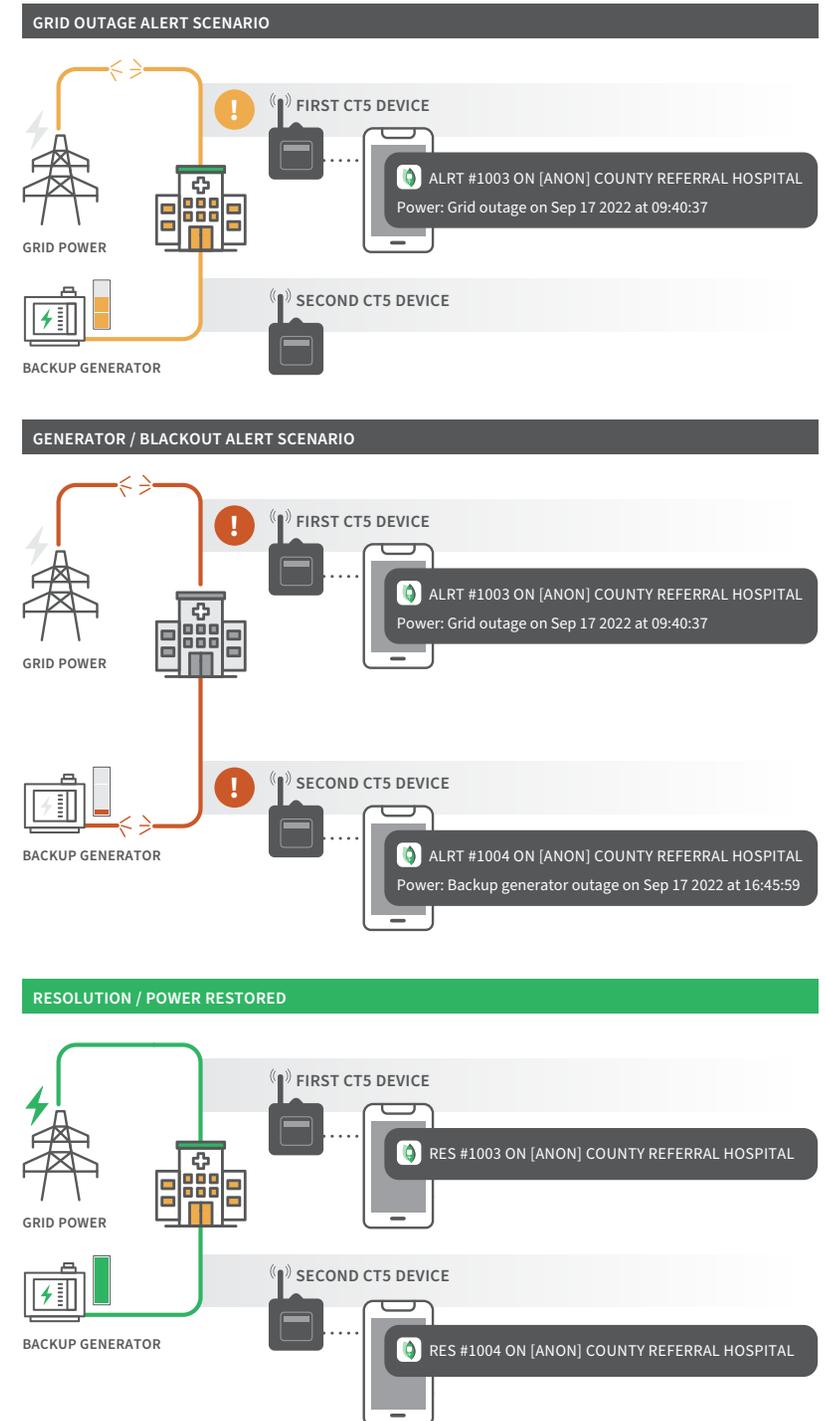
Introducing Power Outage Alerts via Text Message

In July 2022, we launched a collaboration to provide timely power status notifications to the right hospital personnel at the right time. Working with the Kenya Ministry of Health (MOH) and the Centre for Public Health and Development (CPHD), we deployed Nexleaf's CT5 wireless sensor devices to detect power outages at eight hospitals in Kenya. Each hospital was equipped with two CT5s: one to monitor grid power, and the other to monitor backup generator power.

When Nexleaf's system detected an outage, PagerDuty provided real-time text message alerts to BioMeds and MedSups ("users"). Users received grid outage alerts, backup generator outage alerts, and resolution alerts, and all users were trained on how to interpret these notifications.

Nexleaf and CPHD team members in Kenya installed devices, and together with US-based team members they managed alert settings, tracked alerts, and viewed power outage data remotely. Users also joined a WhatsApp group to share their experiences with one another and the Nexleaf and CPHD team.

Project timing and resources did not allow for baseline power outage data collection. Thus, **interviews with users** were key in evaluating the impact of automated alerts. We conducted monthly group interviews that alternated between administrative levels, convening the eight BioMeds one month, and the eight MedSups and Hospital Administrators the next.



Grid Outage Alerts Change the Game

During and after the course of this pilot, we learned that knowing precisely when grid power fails and generators kick in is a game-changer for hospital staff. Users told us that reliable, timely outage alerts help them to reduce the duration of grid power outages and prevent deadly blackouts.

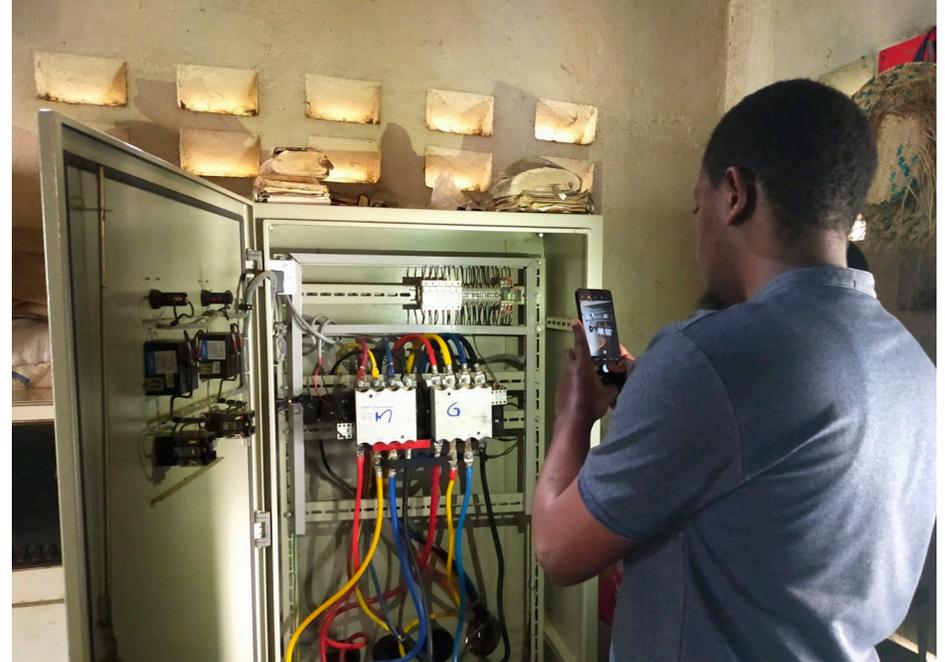
"[W]ith the alerts and with the support of our MedSups, we now do not have fuel shortages anymore. We always have fuel in storage." - BioMed

As we had hoped, grid outage notifications help users maintain adequate fuel supplies for generators to keep power up and running.

What's more: users also stated that **grid outage alerts actually shorten the duration of grid power outages**. Alerts enable hospital staff to contact the power company right away when grid power fails, and data on outages provides an effective tool for resolving problems with the power company. This, in turn, reduces backup diesel fuel costs.

"I get an alert [and] then I'm able to say, okay, fine, let's call Kenya Power and they sort it out." - MedSup

"Diesel consumption has gone down, that is for sure. The reason being [that] we are able to resolve the outage in a shorter time than before...I can say for the last three months we have not had [a grid] outage that's more than four hours." - MedSup



A CPHD team member installs the CT5 wireless monitor for the grid power supply in a hospital power house.

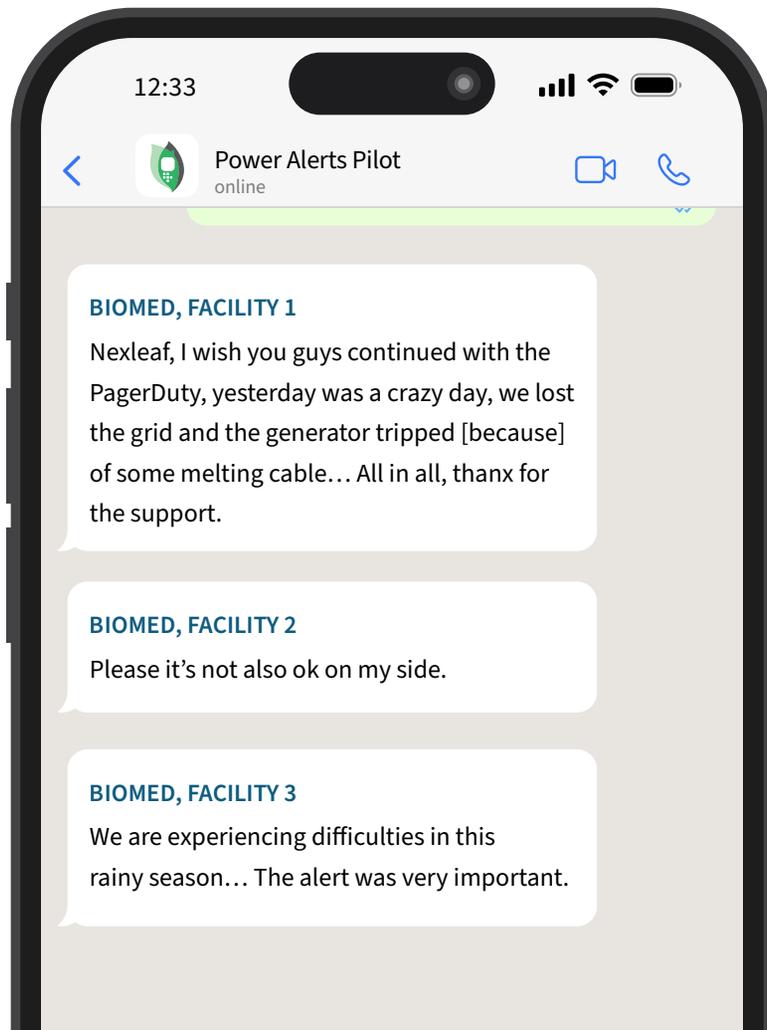
And because personnel on multiple administrative levels have access to the same notifications, power alerts serve as a common source of truth, improving trust and fostering coordination among staff.

"I'm able to track the administrator on the ground and ask them to follow up with the maintenance people so that we are able to resolve it faster, unlike previously where maybe I would be told that there was an outage the following day." - MedSup

Power Notifications Create a Paradigm Shift

Power outage alerts proved so valuable to users that BioMeds asked for the alerts back after the pilot ended. The pilot period concluded in February 2023, so we removed the CT5 devices and stopped the alerts. After that, BioMeds from several hospitals sent emphatic requests to the WhatsApp group asking us to redeploy devices and resume the alerts.

Actual WhatsApp group messages sent by BioMeds after the power alerts pilot ended.



In our experience, this type of response from users – describing such a stark contrast between their day-to-day lives with and without the tech – is very uncommon for a digital health pilot. No doubt, these messages underscore the huge challenges associated with running a hospital with unreliable power. They also speak to a paradigm shift: Alerts give users the power to stop reacting to generator breakdowns and start managing power proactively to prevent the worst-case scenario.

The Future of Power Alerts & Power Monitoring

In response to this project's success, we will redeploy sensors and restart alerts for the eight pilot hospitals – as requested by the BioMeds – as we learn more about what is required to scale this tech. We're also planning an expansion into 75% of Level-5 hospitals in Kenya (approximately 35 facilities in total).

We believe that the need for power alerts is urgent and that demand is likely widespread across hospital facilities in LMICs. Product development support and resources are required to scale sustainably and serve users effectively over the long term. **This relatively simple and low-cost technology has the potential to prevent countless disruptions in critical healthcare delivery and to save many lives—but we can't undertake it alone.**

It's clear that power supply problems are a primary impediment to healthcare delivery in LMICs. Nexleaf is committed to helping countries address grid inadequacies, strengthen backup power resources, build the case for alternative energy options, and deploy modern information systems for managing an uncertain power landscape. This work is critical to the lives of patients and an essential component of quality care access for all.