

2021 LtCol Earl “Pete” Ellis Essay Contest: Second Place

Energy Resilience

Exercises for Marine Corps installations

by Capt Walker D. Mills & Dr. Nicholas Judson

Around 2100 on the evening of 29 October 2012, the lights went out in Manhattan. It would be several days before they were completely restored. Hurricane Sandy was ravaging the mid-Atlantic and ultimately knocked out power for more than eight and a half million homes and businesses across Northeast caused by downed lines and flooded substations.¹ However, in one part of the city, the lights stayed on. In fact, they “shone like a beacon in the night” around New York University’s Washington Square campus because they ran off of a self-sufficient microgrid that provided power and heat to the campus.² Microgrids are areas that are self-sufficient for power that can controllably disconnect from the incoming utility feed and control generation assets in conjunction with changing load requirements. They are increasingly being touted as a way to improve installations energy resilience because they allow installations to decouple from the larger electric grid if it fails and continue to provide power in the face of growing natural and man-made threats to Marine Corps installations. However, before commanders can put resources toward upgrading infrastructure, they need to identify and understand their vulnerabilities. A key way to do this is by holding exercises designed to simulate grid failures and outages either in a tabletop manner or in realtime. These exercises also help personnel train for disruptions, understand their impact on operations, and identify unknown interdependencies that can be just as important as investing in resilient technology and the physical electric grid.

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In order for the equipment to work, personnel have to know how to employ it and commands need to understand how outages will affect their installations. These types of exercises are as important as the physical infrastructure or ensuring the energy resilience of Marine Corps installations and the missions that depend on them in the future.

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Marine Corps installations are critical to competition and any future conflict—in fact, more so than they have ever been. As one Marine colonel put it in the *Marine Corps Gazette*: “Gone are the days where forts, camps, and outposts were merely logistics resupply points, administrative garrisons for mobilizing forces, or listening posts on the frontier.”³ Today, Marine Corps

bases are critical nodes in communications, sensing and logistical networks that Marines and the joint force rely on in competition and conflict. In the future, bases may host and support point defense weapons, directed energy weapons, and computing power that runs AI—requiring increasingly more energy. All those functions rely on reliable and resilient supplies of energy in the form of electricity that powers radars, communications, and computers. Threats to the resiliency of the systems that supply power to our installations need to be taken as seriously as threats to operational units.

At the same time as our installations are more important than ever, both natural and man-made threats to Marine Corps installations are multiplying. Military leaders have repeatedly warned that *the homeland is not a sanctuary*, but even that alone does not convey the full range of threats to Marine Corps installations. Climate change is driving higher-incidences of severe weather around the world that can damage installations in the United States or abroad. In 2018, the eye of Hurricane Michael passed directly over Tyndall Air Force Base—which is home

to part of the Air Force's critically important F-22 "Raptor" fleet. According to the base commander, "Every building on the airbase—100 percent of them spread across 29,000 acres" was severely damaged or destroyed by the storm.⁴ In 2019, massive flooding hit Offutt Air Force Base, home of U.S. Strategic Command. The cost to repair both installations was estimated at nearly five billion dollars.⁵ During the same period, Camp Lejeune and Marine Corps Air Station New River got hammered by Hurricane Florence, which damaged over 800 facilities.⁶ The Corps estimated that it needed three and a half billion dollars to repair those bases.⁷ The highly destructive nature of these storms should be enough to convince any Marine that our installations are at risk at home and abroad.

Climate change is also straining the civilian power grids that supply energy to most defense installations during routine operations. In 2021, a winter storm in Texas caused blackouts in much of the state, leaving millions without power for days when the grid failed catastrophically and potentially cutting the supply of electricity to military bases across the state. In some states, public employees have been sounding the alarm. A commissioner on the Michigan Public Service Commission told the *Washington Post*, "Our electric grid was not built to handle the storms that are coming this next century."⁸ After the disastrous 2021 outages in Texas, an energy systems engineer at Princeton told the *New York Times*, "We have to get much better at preparing for the unexpected,"⁹ regarding climate stresses on electric grids and unplanned outages. Energy readiness exercises are a key way that the Corps can both better understand the risks of disruption and also prepare itself for disruptions that cannot be prevented.

Beyond natural threats, adversary threats to bases overseas and in the homeland are also proliferating. Sabotage, terrorism, and insider threats are nothing new, but the Pentagon's return to strategic competition is also bringing back the threat of long-range, conventional strike from missiles or bombs. Marine Corps bases in the Indo-Pacific are especially vulnerable to China's mas-



Joint Base McGuire-Dix-Lakehurst, NJ, which was in the path of "Super Storm" Sandy, conducts "pull the plug" Energy Resilience Readiness Exercises (ERRE) to train resiliency in the face of threats. (Photo by Gianna Greben.)

sive arsenal of conventional ballistic missiles that can reach bases in Japan and Guam and their bomber fleet that can launch cruise missiles with a similar combined range. A report by the Center for New American Security think-tank argued that the single biggest threat to the U.S. military in Asia was "the growing capability of China's missile forces to threaten U.S. bases in the region."¹⁰

Cyberthreats are another vector that will stress electric grids with the potential to cause devastating failures. The apparent ease with which non-state actors have targeted U.S. companies and critical infrastructure like the Colonial Pipeline with cyberattacks should be extremely worrying for installations that expect to receive some amount of power from external grids.¹¹ The ransomware attack on the Colonial Pipeline shut down petroleum movement for days and caused gas stations across the Southeastern United States to run dry. The civilian electric grids that defense installations rely on can be taken for granted, even if the primary infrastructure is secure—the subsystems on which they rely—could be the targets of cyberattacks which would have the ultimate effect of cutting the electricity supply to Marine Corps installations.

When severe weather strikes military bases, it can take years for the damages to be fully repaired. But, usually the most critical fixes are getting the lights back on—bases need power to run and to support operations. Units can operate without some facilities and infrastructure, but electricity is critical for even routine operations and installations will be increasingly important for supporting combat operations. Then Deputy Commandant for Combat Development and Integration, LtGen David Berger, wrote in a functional concept for Future Installations and Logistics Development that

Optimizing installations will support the lethality of Marine Corps forces by providing the means to ensure critical capabilities are maintained and provided in all environments. Resiliency efforts ensure the capacity to maintain support to the force before, during, and after deployment. Accordingly, our bases and stations must become better prepared and able to withstand kinetic and non-kinetic attacks at home and abroad while maintaining an operational capability.¹²

Not all outages are preventable; the enemy always has a way and mother nature always finds a way. In order to prepare for these cases when outages

cannot be avoided, education and training are important because they both create an understanding of how an installation can operate without power and help personnel mitigate the effects of an outage when it strikes.

One of the specific ways that installations can improve their readiness for energy disruptions is with Energy Resilience Readiness Exercises. Energy Resilience Readiness Exercises are exercises that were first sponsored by the Deputy Assistant Secretary of Defense for Energy and run by engineers from the Massachusetts Institute of Technology's Lincoln Laboratory at multiple bases since 2018.¹³ The Air Force ran at least five of them at its installations in 2021.¹⁴ These so-called "pull the plug" exercises are essentially trial runs for disruption where entire installations are disconnected from the local power grid with little warning (but with much planning). Another way is through tabletop exercises. MIT Lincoln Laboratory has also run tabletop exercises for installations that focus on installation and unit leadership. They do not involve the whole installation and they can be tailored to different scenarios and be played out over days or weeks instead of just hours, but they



Marine Corps Air Station Miramar tested the efficiency of a microgrid power plant during an Energy Resilience Readiness Exercise in February 2021. (Photo by Sgt Jorge Rosales.)

and the Marine Corps' Installation Energy Strategy. If you want to know what will happen if a base disconnects from the grid, all you have to do is pull the plug yourself. The conversations before the exercises happen align installation personnel with mission needs and concerns so that commanders can understand and mitigate potential risks.

technician on leave? How will the MPs manage traffic flows if all the stoplights on base turn off at the same time?

Second, these exercises are training events for disruptions, and they force installations to practice and refine their procedures for a power outage—primarily shifting the installation to power generated on base. Like any skill, the ability to manage a power outage is perishable, and some installation managers may have never actually done it. These procedures need to be practiced or they will be lost, and it will be harder to perform in an emergency.

Third, these exercises are also excellent ways to demonstrate to leaders and mission owners across the installation the importance of energy resilience. There is nothing like being faced with a gate that will not open, servers without power, or down communications that reminds leaders of the importance of energy resilience. You can think it will not happen on your installation until the moment that it does. However, these exercises are done in a controlled setting where if there are serious unexpected consequences, the power can be restored and issues can be fixed before their capabilities are needed during conflict—without larger cost to the mission.

At 0700 on the morning of 19 November 2020, the lights went out on

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do not have the realism of an actual black start exercise, and their findings depend on the discovery of electrical or communications system configurations that are informative to test in a tabletop setting.

These types of exercises have three general benefits. First, they are the simplest way for installations to understand their own vulnerabilities and the shape of potential disruptions on base. Identifying installations vulnerabilities is critical to both the overarching Marine Corps' Expeditionary Energy Strategy

These exercises force installation personnel to test their own equipment and procedures and identify failures. Often, plans do not fare as well in practice as they looked on paper and equipment does not perform as well as expected. Small details like the type of connections between generators and the battery life of back up servers are all tested in a realistic training event, under real operating conditions. It also highlights other non-physical vulnerabilities and other points of failure. For instance, is your only qualified electrical repair

Joint Base McGuire-Dix-Lakehurst. This time there was no storm, no flooded substation, and no ransomware or People's Liberation Army missile attack. It was just an exercise, and the power came back after about twelve hours instead of several days. Some of the base's equipment performed and started generating power within minutes after it was disconnected from the grid, other equipment did not. The command was able to identify the deficiencies and gaps in their systems so that they could be addressed. The installation leadership discovered "interdependent vulnerabilities between facilities" that had been overlooked in emergency circuits, power storage, and power generation that can be addressed before the lights go out again.¹⁵ In sum, it was a smashing success that will make the installation more resilient in the future. These exercises have also occurred at many other Army and Air Force installations with more in the pipeline to identify needed fixes and ensure readiness for our forces and mission essential functions.

The Marine Corps has started implementing the concept of energy resilience exercises: in conjunction with the final commissioning of a microgrid at MCAS Miramar, the installation performed a planned base-wide power outage in February 2021 to understand the microgrid's capabilities. Miramar's innovative microgrid relied on a combination of diesel generators, solar panels, natural gas generators, and gas captured from Miramar's landfill. 3d MAW continued to operate and fly during the exercise, a real-world test of the capabilities and needs of mission partners in a way that traditional energy resilience planning has not typically included. The success of the exercise, which included two, six-hour shutoffs, confirmed that Miramar would not only be able to operate unhindered in the event that it needed to generate its own power but that it could also serve as "an emergency hub for city, county, state, and federal relief efforts" in the event of a crisis or emergency in Southern California according to the installation commander.¹⁶ The Marine Corps should continue to expand on these capabilities and run energy readiness exercises at regular

intervals on all of its installations to guide and test investments in physical readiness. Whether they are full "pull the plug" exercises or simpler tabletop games, exercising is a critical and often unappreciated piece of installation readiness that the Marine Corps cannot afford to overlook.

Notes

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