



Fort Knox, Kentucky

CASE STUDY

February 2021

Fort Knox, the first PEER certified defense facility in the world

Electricity is a basic necessity for the defense sector, as it aids security functions and efforts. A power outage, then, will put the military at unacceptable risk. This is why they must prepare for a disruption in power service.

Fort Knox, also called "The Vault", is a United States Army post in Kentucky, south of Louisville and north of Elizabethtown. The 109,000-acre base is home to the Army Human Resource Command Center, high school and the famous 'Gold Vault'.

Fort Knox has installed a microgrid, in addition to the utilities main power supply. This microgrid is comprised of **Natural Gas Generators, Diesel Generators and Solar Photovoltaic Panels**. This allows for the capability to operate independently from external power sources. In fact, Fort Knox uses natural gas from beneath the army post's surface, a first of its kind in U.S. military.

Fort Knox pursued and achieved PEER certification in 2018, because of a desire to evaluate their power system against global standards and improve the reliability of these systems. This effort led to them **becoming the first defense facility to achieve PEER Silver certification in the world**.



RELIABLE MICROGRID – BOLSTERING ENERGY SECURITY

Fort Knox has used PEER to ensure reliability and resiliency of their power system. Their 2014 energy project renovation allowed for four of six natural gas-fired generator sets (24 MW) to provide power to the base through a combined heat and power (CHP) system. This \$60 million project also includes ten diesel generator sets (20 MW), which are used primarily for backup power.



The whole energy infrastructure is monitored from their central automated control center known as the “bunker.” This cyber-secured control center, connected to all tenant facilities and energy systems, comprises of dual redundant SCADA (Supervisory Control and Data Acquisition) system which:

- ▶ Manages energy consumption in real-time,
- ▶ Diagnoses technical issues and notifies operators,
- ▶ Compiles analyzed data of energy systems.

Further, the control center has the capability to automatically manage the natural gas generators based on the utility power supply and energy demand of the facility. Because the entire facility is considered to be critical this distributed generation system can be automatically started in case of any interruption in utility power supply. This has the potential to restore 100 percent of the facility’s power for long periods of time, ensuring resilience in the face of emergencies or natural disasters.



In addition to the SCADA system, Fort Knox has installed smart meters enabled with bidirectional communication between the facility and the utility. The control center transforms data generated by these smart meters into a detailed, 3D optical energy report which provides a visualization of building energy data that can be used to better manage the whole facility for sustained results.

To ensure safer and faster communication between the control center and supplying utility, Fort Knox utilizes a fiberoptic ring topology communications network to communicate with distribution substations and downline devices, as well as the generator plants. With all these systems, the much-needed support for their military system operations is ensured.

RENEWABLE ENERGY – STRENGTHENING RESILIENCE

PEER also encourages projects to adopt renewable energy and reduce their greenhouse gas emissions.

As a result of this, Fort Knox has adopted solar energy solutions, installing **1.57 megawatts of solar PV systems on the campus rooftops** and another **2.1 megawatts of solar panels across 10 acres**.



By implementing the solar-powered microgrid inside the base, Fort Knox is able to provide a resilient energy system that not only reduces operating cost but also reduces dependency on grid power. **With their solar installation, Fort Knox mitigates about 3.8 kilotons of carbon emissions every year.**

As the fifth-largest coal producer in the nation, Kentucky has about one-fifth of all operating U.S. coal; more than any other state except Pennsylvania. In 2018, about 75% of Kentucky's net electricity generation was coal-fired, the third-largest share of any state after West Virginia and Wyoming. This, of course, means that air quality is a concern.

Fort Knox developed the Energy Efficiency & Environment (EE) Index score, which quantifies the environmental impact of project's electricity consumption. EE Index is calculated using the project's performance metrics (Source Energy Intensity, CO₂, SO₂, NO_x, water consumption, and waste intensity). The EE Index score of Fort Knox is 50, more than twice that of Kentucky's benchmark value of 19

LOAD MANAGEMENT AND ENERGY CONSERVATION

Projects that can reduce peak loads or shift their loads to off peak hours, can take advantage of Time-of-Day (TOD) pricing schemes. The utility offers different rates for predefined on-peak and off-peak hours of the day. TOD rates help customers reduce electricity costs while

the utility relieves strain on the grid.

Through the implementation of the natural gas peak shaving plant and the TOD pricing scheme, Fort Knox has created a price-responsive electricity demand with higher utilization and lower peak power prices. The combination of the natural gas peak shaving generation systems and solar photovoltaic systems enable Fort Knox to set and meet monthly targets. Through such measures, **the project achieved cost savings of \$14.6 million from 2015-2017.**

Additionally, Fort Knox supports the yearly energy reduction goals set by the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007. In 2013, Fort Knox kicked off an LED retrofit operation, installing more than 9.5 thousand LED bulbs. This **LED retrofit operation saves nearly 1 million units (1 GWh) of energy annually** for Fort Knox, and helps the project meet its sustainability goals.

PEER CERTIFICATION

PEER is a certification program that measures and improves power system performance and electricity delivery systems. The PEER rating system evaluates strategies in six categories:

- ▶ Reliability and Resiliency (RR)
- ▶ Energy Efficiency and Environment (EE)
- ▶ Operations, Management and Safety (OP)
- ▶ Grid Services (GS)
- ▶ Regional Priority (RP)
- ▶ Innovation (IN)

Out of a possible 110 points, **Fort Knox earned 54 points**, achieving **PEER Silver certification**.

Through PEER Certification, Fort Knox realized the importance of assessing power interruptions and improving their power system reliability through power system hardening techniques, such as undergrounding power distribution cables. The Fort Knox team also gained insights on strategies to reduce the local environmental degradation caused by energy infrastructure development.

PEER Certification for Campus Projects	
Certified 30 August 2018	
Total Points Achieved	54
Reliability and Resiliency	11
Energy Efficiency & Environment	09
Operations, Management & Safety	18
Grid Services	13
Innovations & Regional Priority	03
Total Possible Points	110

About PEER

Performance Excellence in Electricity Renewal (PEER) is a rating system and certification for defining, assessing and verifying the overall sustainable performance of electricity delivery system design and operations. PEER is designed to deliver sustainable, resilient and reliable energy around the globe. Learn more: peer.gbci.org

About Fort Knox

Fort Knox provided information from publicly available resources for this certification, but as a U.S. governmental activity, the installation may not and does not endorse or promote the efforts of any particular rating or evaluation agency.