

DC Microgrid Study



Technology Overview

The DC microgrid study will evaluate the degree to which the direct current (DC) microgrid enables more cost-effective and resilient buildings by enhancing the efficiency of on-site energy generation and storage and minimizing the losses associated with AC-to-DC conversions. Historically, building loads have been predominantly alternating current (AC), but today an ever-increasing proportion of loads (electronics, LED lighting, variable frequency motors, etc.) use direct current (DC) and therefore require a conversion from AC to DC in order to operate. Each AC-to-DC conversion results in efficiency losses as well as potential reliability issues. The DC microgrid connects on-site energy generation and storage devices directly to DC loads, eliminating conversion and its inherent losses and optimizing the utilization of onsite energy generation and storage. The DC microgrid can operate in parallel to the AC infrastructure within a facility.

Why is GSA Interested?

The DC microgrid promises to increase resiliency by providing backup power to critical loads. It eliminates losses due to power conversion and offers a 7% to 10% increase in electrical efficiency. Connecting DC devices directly to solar photovoltaic (PV) power sources eliminates the need for AC/DC conversion equipment—rectifiers and DC/AC inverters—thereby lowering solar PV installed costs by as much as 15% and increasing reliability, as rectifiers and inverters are often the first devices to fail. Using a DC architecture can also decrease equipment costs, as power conversion electronics are eliminated, and increase DC component life because the components run cooler when run with their native current.

How Will Success Be Measured?

The DC microgrid should decrease whole-building electricity by 7% with payback under 5 years. The study will also evaluate the microgrid's impact on operations and maintenance, and its ability to shift power consumption during periods of demand response and identify and drop non-critical loads during periods of peak demand.

Deployment Potential

The DC microgrid is best suited to new construction and major renovation or to facilities with existing onsite energy generation and storage.

U.S. General Services Administration (GSA), in association with a Department of Energy national laboratory, is evaluating the real-world performance of a DC microgrid in federally owned buildings within GSA's inventory. The technology will be provided by Direct Energy Partners and coordinated with other ongoing evaluations of this technology.