RESILIENT POWER PROJECT CASE STUDY

Boston Medical Center

New England's Largest Safety-Net Hospital Installs Energy Storage

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CleanEnergyGroup

RESILIENT POWER PROJECT CASE STUDIES

This case study is one in a series by Clean Energy Group (www.cleanegroup.org) produced as part of the Resilient Power Project, which aims to accelerate the equitable deployment of clean, affordable, and resilient power technologies in historically marginalized and underserved communities nationwide. This case study series highlights installations of solar PV combined with battery storage (solar+storage) to demonstrate their economic, community resiliency, and health benefits. More information about this project and others can be found at www.resilient-power.org.

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DISCLAIMER

Cover image: Battery system installed on the grounds of Boston Medical Center. Photo courtesy of Boston Medical Center.

Boston Medical Center

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PROJECT CONTACTS

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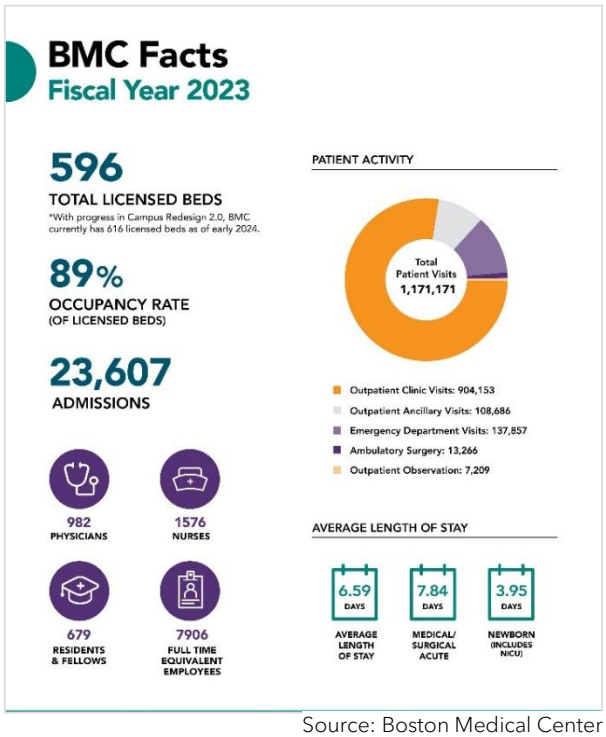
BATTERY STORAGE FOR BOSTON MEDICAL CENTER

The Boston Medical Center project demonstrates the opportunity for hospitals to use battery storage to reduce energy costs and improve patient care.

THE CHALLENGE: **Reducing the Energy Burden at Boston's Busiest Trauma Center and Hospital**

Hospitals must function around the clock every day of the year to provide essential healthcare and lifesaving services. Boston Medical Center (BMC) is the busiest trauma and emergency services center in New England, admitting over 20,000 patients and treating over 130,000 emergency department visits annually.[1] Patient care is both a vital and valued service and it is energy intensive.

On average, hospitals use twice as much energy per square foot as the average commercial building,[2] and the COVID-19 pandemic only increased hospitals' reliance on consistent and high-quality power. Coronavirus critical case treatment plans typically include electrical devices such as vital signs monitors, IV machines, and ventilators. In the first six months of the pandemic, hospital energy consumption increased sixfold.[3] Increased energy use translates to higher utility bill costs.



Source: Boston Medical Center

In addition to the amount of energy consumed, utility bills are also affected by capacity demand charges and transmission and distribution (T&D) charges (charges added to commercial electric bills that pay for peak power and transmission and distribution grid costs, which are based on the facility's peak electricity demand each month). When this battery storage project was planned, BMC's capacity and transmission costs exceeded $1 million annually. If the hospital could manage its energy demand and thereby lower these high utility costs, it could put this money to better use by redirecting it to support patient care and clinical programs.

[1] Boston Medical Center, *Emergency Medicine*, https://www.bmc.org/emergency-medicine, (accessed April 8, 2025).
[2] Khaled Bawaneh, Farnaz G. Nezami, et al., "Energy Consumption Analysis and Characterization of Healthcare Facilities in the United States," *Energies*, October 4, 2019, https://doi.org/10.3390/en12193775.
[3] Diana Sabau, "Lights Out! U.S. States Where Energy Consumption Rose or Fell During Lockdown," *CommercialCafe*, October 19 2020, https://www.commercialcafe.com/blog/us-energy-consumption-during-lockdown.

THE SOLUTION: **Energy Storage**

In 2022, BMC installed a Tesla Megapack, a 572 kilowatt/1,251 kilowatt-hour lithium-ion battery energy storage system. The battery is ground mounted behind the central plant and connected to the hospital's 480-volt chiller switchboard, allowing the battery to provide capacity to meet BMC's summer peak load, which is primarily the result of energy-intensive air conditioning.[4]

Battery being installed at Boston Medical Center. Source: Boston Medical Center

A hospital's cooling system often contributes a high proportion of its total energy consumption, because hospitals operate under stricter air quality requirements compared to other businesses. In a study of energy use in hospitals across the United States, cooling systems accounted for 11 percent of the total energy use on average.[5] By connecting the battery to the cooling system, BMC anticipates saving approximately $131,175 annually on utility bills. In addition, the battery system offers several other benefits.

Environmental Impact. The battery energy storage system is a component of BMC's campus modernization plan, which focuses on energy efficiency, resiliency, and greenhouse gas (GHG) emissions reductions. The hospital has reduced its carbon emissions from energy consumption by 94 percent through aggressive implementation of energy consumption measures, composting its food waste, improving its sustainability practices, and entering into a 60-megawatt solar partnership.[6] Moving forward, BMC is committed to further reducing its carbon emissions through electrification as new sustainability technologies become available.

Serving Low-Income and Underserved Communities. BMC is the largest essential hospital in New England and as such, serves all patients who come through its doors, including those without insurance and those who are publicly insured. Located in Boston's South End, over 50 percent of BMC's patients come

[4] Winter peak demand is relatively minimal, and the hospital's combined heat and power (CHP) facility provides the needed heat and hot water.

[5] Khaled Bawaneh, et al, "Energy Consumption Analysis and Characterization of Healthcare Facilities in the United States," *mdpi.com*, https://doi.org/10.3390/en12193775.

[6] Through a unique solar purchase and partnership, BMC enabled the construction of a 60 MW solar farm in North Carolina. BMC's 26 percent solar purchase portion covers 100 percent of the hospital's electric consumption. BMC signed a 25-year PPA with Dominion, the project's owner, see https://www.bmc.org/about-us/environmentally-friendly-campus/solar.

from underserved populations and over 30 percent are non-native English speakers.[7] By reducing the hospital's annual costs with battery storage, BMC can reinvest those savings into care for its communities.

Leading by Example. In the United States, healthcare facilities account for about 5 percent of all commercial floorspace; however, they account for nearly 10 percent of total commercial building energy consumption.[8] In Boston, all major metro hospitals combined consume over 6.6 trillion British thermal units (Btu) of energy annually. Organizations such as Health Care Without Harm and the Green Ribbon Commission partnered with Boston hospitals to reduce their energy consumption and increase their efficiency. Over the first four years of their partnership, all Boston hospitals decreased their combined energy use by 9.4 percent.[9] In addition to traditional efficiency measures, BMC has now demonstrated that hospitals can employ battery storage to create additional utility bill savings.

BMC has now demonstrated that hospitals can employ battery storage to create significant utility bill savings.

Energy storage can also decrease the state's reliance on gas-powered peaker plants by reducing peak electricity demand. Since 2016 when BMC began planning for a battery energy storage system, two other hospitals in the Boston metro area have applied for and received funding to install lithium-ion batteries. More area hospitals could adopt the same technology and realize similar benefits.

This is significant because of the outsized role hospitals play in the economy. Within the Boston metro area, hospitals account for over 24 million square feet of space in over 65 buildings, and healthcare is the largest single segment of the Boston economy.[10] Combined with their high energy intensity, this gives hospitals and healthcare facilities an unparalleled opportunity to lead the integration of battery energy storage systems within the commercial sector.

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[7] Boston Medical Center, "GME Diversity and Inclusion," https://www.bmc.org/medical-professionals/office-minority-physician-recruitment.

[8] "Integrating Health and Energy Efficiency in Health Facilities," *U.S. Department of Energy Office of Energy Efficiency & Renewable Energy*, June 2021, https://www.energy.gov/femp/articles/integrating-health-and-energy-efficiency-healthcare-facilities.

[9] "Metropolitan Boston Health Care Energy & Greenhouse Gas Profile: 2011 through 2015, and 2020 Projection," *Health Care Without Harm*, https://noharm-uscanada.org/sites/default/files/documents-files/4723/Report-Boston%20Health%20Care%20Energy%20Profile-May%202017.pdf.

[10] Massachusetts Clean Energy Center, "Advancing Commonwealth Energy Storage," masscec.com, https://www.masscec.com/advancing-commonwealth-energy-storage-aces-program.

Project Overview

Property owner and occupant: Boston Medical Center

System owner and manager: Boston Medical Center

Electrical contractor: C&W Electric

Equipment: 572-kW/1,251-kWh lithium-ion battery energy storage system installed behind the meter

Building loads supported by the storage system: During normal operation, the battery connects to the hospital's 480-volt chiller switch board, allowing the battery to provide capacity to meet BMC's summer peak load, which is primarily air conditioning.

Services provided: Utility bill cost savings

Supported infrastructure: Critical care hospital

Battery vendor: Tesla

Project partners: C&W Electric, Alternate Power Source

Revenue and cost savings sources: Reducing utility transmission and distribution (T&D) charges; reducing ISO New England installed capacity (ICAP) charges; and performance payments from Massachusetts' ConnectedSolutions active demand response program.

Photo courtesy of Boston Medical Center

FINANCIAL DETAILS

Project Costs. The project cost was $1,330,796, which reflects the total cost of the 572-kW/1,251-kWh lithium-ion battery, design, installation, fees, taxes, shipping, plus inverters and other equipment. Operations and maintenance are estimated at $6,600 per year. See Table 1.

Table 1 - Project Economics

Initial costs and credits	Equipment & installation costs	$1,330,796
	MassCEC & DOER ACES grant	$402,500
Annual savings	Massachusetts ConnectedSolutions performance payments	$83,400
	Transmission and distribution charge reductions	$35,002
	ISO-NE ICAP charge reduction	$20,016
Annual cost	Operations & maintenance	$6,600
Simple payback	Without ACES grant	10 years
	With ACES grant	7 years

Source: Clean Energy Group

Project Financing. BMC received a $402,500 grant from the Massachusetts Clean Energy Center (MassCEC) and the Massachusetts Department of Energy Resources (DOER) through the Advancing Commonwealth Energy Storage (ACES) grant program. The ACES program was created to demonstrate the benefits of energy storage and encourage further deployment of the technology. In total, ACES distributed more than $20 million in grants.[11]

BMC paid the remaining project cost. Sandia National Laboratories and the Clean Energy States Alliance provided technical assistance.

Anticipated Savings. BMC anticipates cost savings and revenues from three sources.

- The Massachusetts ConnectedSolutions program leverages the energy stored in BMC's battery to reduce regional peak electricity demand. Through ConnectedSolutions, BMC's electric utility will draw on the energy stored in the hospital's battery during summer peak energy demand events. This alleviates the utility's need to rely on gas-powered "peaker plants" for electricity. The Connected-Solutions program pays $200 per kilowatt delivered during the summer months. In total, BMC anticipates earning **$80,000 annually** from the ConnectedSolutions program.
- **Transmission and Distribution (T&D) charges** are collected by the electric utility to pay for the operations and maintenance of the electric grid. These charges are calculated based on the facility's

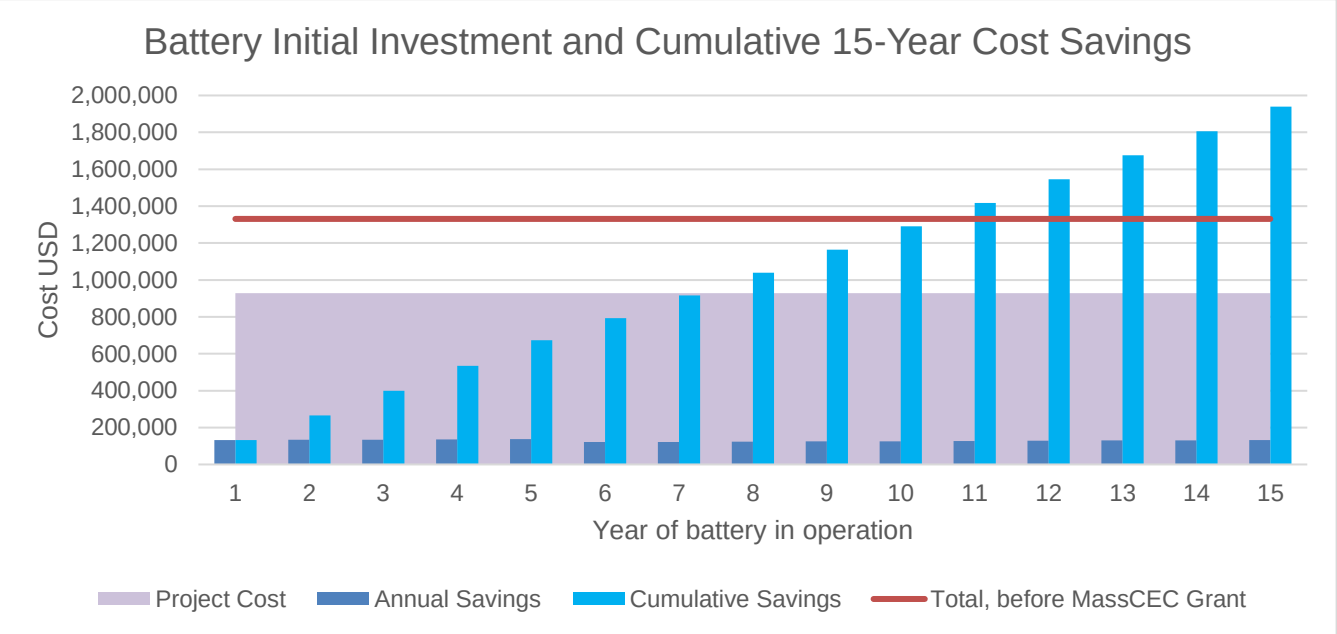
[11] Massachusetts Clean Energy Center, "Advancing Commonwealth Energy Storage," masscec.com, https://www.masscec.com/advancing-commonwealth-energy-storage-aces-program.

monthly peak demand. By using the battery to manage monthly peaks, BMC can avoid a portion of its T&D capacity charges from the utility. The hospital pays at a rate of $27.51 per kilowatt per month, meaning BMC's battery could save the hospital **$40,255 annually** in avoided T&D charges.

- **ISO-NE capacity (ICAP) charges** are added to facility electric bills to help pay for regional capacity costs, based on annual peak demand. Using the battery to manage annual peak demand would reduce BMC's ICAP charges by $3.65 per kilowatt, equating to $1,460 per month in ICAP savings, or over **$17,520 annually.**

In total, BMC anticipates the battery will create $137,775 of gross savings and revenues annually. After $6,600 for system operations and maintenance, the net annual savings are $131,175. A simple payback of the battery is estimated to take seven years, or 10 years if the ACES grant is not counted toward the total. See Figure 1.

Figure 1: Battery system cost savings and payback



Source: Clean Energy Group

CONCLUSION

Healthcare organizations in the United States spend over $6.5 billion on energy each year.[12] According to the U.S. Energy Information Administration, hospitals consume more than eleven times more electricity than any other building type.[13] In areas where utility demand charges are high, 50 percent or more of a hospital's total cost for electricity can be due to demand charges, which are based on the facility's monthly peak electricity demand. Reducing monthly peak demand charges can free up millions of dollars that could be redirected to support patient care. But demand charges cannot be efficiently and effectively managed through renewables alone, or even by using behind-the-meter spinning generators such as combined heat and power plants, which are highly efficient when running continuously at a steady state but are not designed to ramp up and down quickly in response to fluctuating electricity demand. Boston Medical Center's battery project demonstrates how hospitals can integrate energy storage into an efficiency or sustainability program to better manage peak demand and lower costly demand charges.

Reducing monthly peak demand charges can free up millions of dollars that could be redirected to support patient care.

Photo courtesy of Boston Medical Center.

[12] U.S. Energy Star, "Healthcare: An Overview of Energy Use and Energy Efficiency Opportunities," https://www.energystar.gov/ia/partners/publications/pubdocs/Healthcare.pdf.

[13] U.S. Energy Information Administration Commercial Buildings Energy Consumption Survey, https://www.eia.gov/consumption/commercial/data/2018/ce/pdf/c14.pdf.

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