Metropolitan Boston health care energy and greenhouse gas profile: 2011 through 2022, and 2030 projection

Produced by Health Care Without Harm on behalf of
Boston Green Ribbon Commission Health Care Working Group

Analytics by Environmental Health & Engineering

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Summary

The years 2020, 2021, and 2022 were tumultuous, as the health care sector and the world at large grappled with the COVID-19 pandemic and its myriad impacts. Despite these massive disruptions, the health sector in Boston has maintained the progress made in prior years on reducing greenhouse gas (GHG) emissions.

Site emissions, from the baseline of 2011, have dropped 22%. If energy consumption, grid mix, and emission factors (EFs) are held constant, the hospitals included in this analysis avoided almost 700,000 metric tons of CO_2 equivalent (MTCO2e) of site emissions over the 11 years analyzed. This is equivalent to the yearly electricity use of 145,000 homes.[1] This reduction was possible through a number of projects undertaken by the hospitals included in this analysis, including energy conservation, on-site low-carbon energy production, contracts with low-carbon energy producers, and private renewable power purchases.

In 2021, Health Care Without Harm published an analysis of Metro Boston hospitals' energy consumption and GHG emissions from 2011-2019. Here, the analysis is extended to include 2020-2022, a period marked by challenges including the COVID-19 pandemic, disruption of energy markets, rising interest rates, and three of the seven highest recorded annual global surface temperatures.[2,3,4] GHG emissions from the hospitals included in this analysis have leveled off since the significant progress in the second half of the 2010s. However, a path to

1 U.S. EPA, "Greenhouse Gas Equivalencies Calculator." https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.
2 IEA, "Russia's War on Ukraine – Topics," accessed October 3, 2024. https://www.iea.org/topics/russias-war-on-ukraine.
3 Federal Reserve Economic Data, "Federal Funds Effective Rate," accessed October 1, 2024. https://fred.stlouisfed.org/series/FEDFUNDS.
4 NOAA National Centers for Environmental Information, "Monthly Global Climate Report for Annual 2022," published online January 2023, accessed June 24, 2024. https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202213/supplemental/page-1.

reducing annual GHG emissions by 50% by 2030 still exists through a focus on emissions from electricity.

The purchase of renewable energy through power purchase agreements (PPAs) and retirement of the related renewable energy certificates (RECs) will be a key tool in achieving this goal, along with the scheduled increase of renewable energy in the New England grid mix. Electrifying buildings to reduce natural gas use should also be considered a priority, to continue reducing Scope 1 stationary combustion emissions. By making investments in renewable energy and on-site projects including energy efficiency and electrification, these hospitals can continue making progress toward honoring their emissions reduction commitments, meeting city and state requirements, and representing Boston-area hospitals as leaders in health care sector sustainability.

While significant progress has been made, more work remains. This report serves as a call to action for continued innovation and commitment to sustainability within the health care sector. As Metro Boston hospitals strive to meet their emissions reduction goals, the collective effort to prioritize renewable energy and emission-reduction strategies will be essential in achieving a healthier, more sustainable future.

Context

Health Care Without Harm commissioned this report on behalf of the Boston Green Ribbon Commission's Health Care Working Group (HCWG), retaining Environmental Health & Engineering, Inc. (EH&E) to study GHG emissions from Boston hospital buildings between 2011 and 2022. 40,000 records of energy consumption and GHG emissions were analyzed for 13 HCWG member hospitals in and around Boston. The goal was to highlight Boston hospitals' efforts to cut carbon emissions and show the importance of tracking and sharing progress toward low-carbon building operations.

Participating organizations included Beth Israel Deaconess Medical Center, Boston Children's Hospital, Boston Medical Center, Dana Farber Cancer Institute, Mass General Brigham, and Tufts Medical Center. This analysis has some small variations from the 2021 analysis of emissions between 2011 and 2019. This analysis is updated with newly available EFs, and adjustments were made to reconcile any gaps in utility data. There are also changes to the scope of buildings included in the analysis; this year, parking structures and buildings that are outside of Metro Boston are not included. Due to the combination of these adjustments, the annual MTCDE totals are slightly higher than in our prior analysis. Due to issues with data availability, we assume 2020 energy consumption levels for one facility in 2021 and 2022; emissions are not the same for these years, as EFs vary.

Metro Boston hospitals spend over $200 million annually on energy in their over 28 million square feet of owned buildings.[5] They undertake thousands of actions each year to tune and improve the performance of equipment and operating systems in their complex, 24/7 facilities. Designing and upgrading buildings with sustainability in mind has become an emerging priority for the hospitals included in this analysis.

For example, in 2022, Boston Medical Center (BMC) opened the nation's first net-zero behavioral health center in Brockton. Using $12 million in state funding, BMC bought a former nursing home and retrofitted it as a behavioral health facility.[6,7] BMC added geothermal, energy efficient windows, and a five-inch insulated facade. The total project price tag was $35 million and included a $6 million anonymous donation.[8]

In Boston and Cambridge, hospitals and commercial property owners must report their annual GHG emissions and energy usage.[9,10] The data from these programs show hospitals and patient care facilities contribute 10% of the GHG emissions from buildings covered by these cities' disclosure rules.[11] These large, non-residential properties in Boston are subject to limits on GHG emission intensity beginning in 2025, with a requirement of net zero by 2050.[12] In Cambridge, large, non-residential buildings must achieve net zero by 2035.[13] Organizations that have already initiated efforts to document and understand their emissions are well-positioned to address these requirements.

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[5] Cost calculated based on average energy prices in Massachusetts reported by EIA. Total square footage was calculated from data submitted by institutions.

[6] BMC, "Boston Medical Center Announces Opening of New Inpatient Behavioral Health Center in Brockton," accessed October 19, 2024. https://www.bmc.org/news/boston-medical-center-announces-opening-new-inpatient-behavioral-health-center-brockton.

[7] WBUR, "Boston Medical Center to open inpatient psychiatric and substance use treatment center in Brockton," accessed October 19, 2024. https://www.wbur.org/news/2022/09/14/bmc-brockton-behavioral-health-center.

[8] The Commonwealth Fund, "Greening the Health Care Safety Net," accessed October 19, 2024. https://www.commonwealthfund.org/publications/case-study/2023/aug/greening-health-care-safety-net.

[9] City of Boston, "Building Emissions Reduction and Disclosure," accessed October 20, 2024. https://www.boston.gov/departments/environment/berdo.

[10] City of Cambridge, "Building Energy Use Disclosure Ordinance," accessed October 20, 2024. https://www.cambridgema.gov/CDD/zoninganddevelopment/sustainabledevelopment/buildingenergydisclosureordinance.

[11] Environmental Health & Engineering, Inc. analysis of emissions data 2020 reported by the City of Boston Building Emissions Reduction and Disclosure Ordinance (BERDO) and the City of Cambridge Building Energy Use Disclosure Ordinance (BEUDO). https://www-healthaffairs-org.ezp-prod1.hul.harvard.edu/doi/10.1377/hlthaff.2020.01247.

[12] City of Boston, "Building Emissions Reduction and Disclosure, How Do I Get Started with Emissions Compliance?" accessed October 20, 2024. https://www.boston.gov/departments/environment/berdo#emissions-compliance.

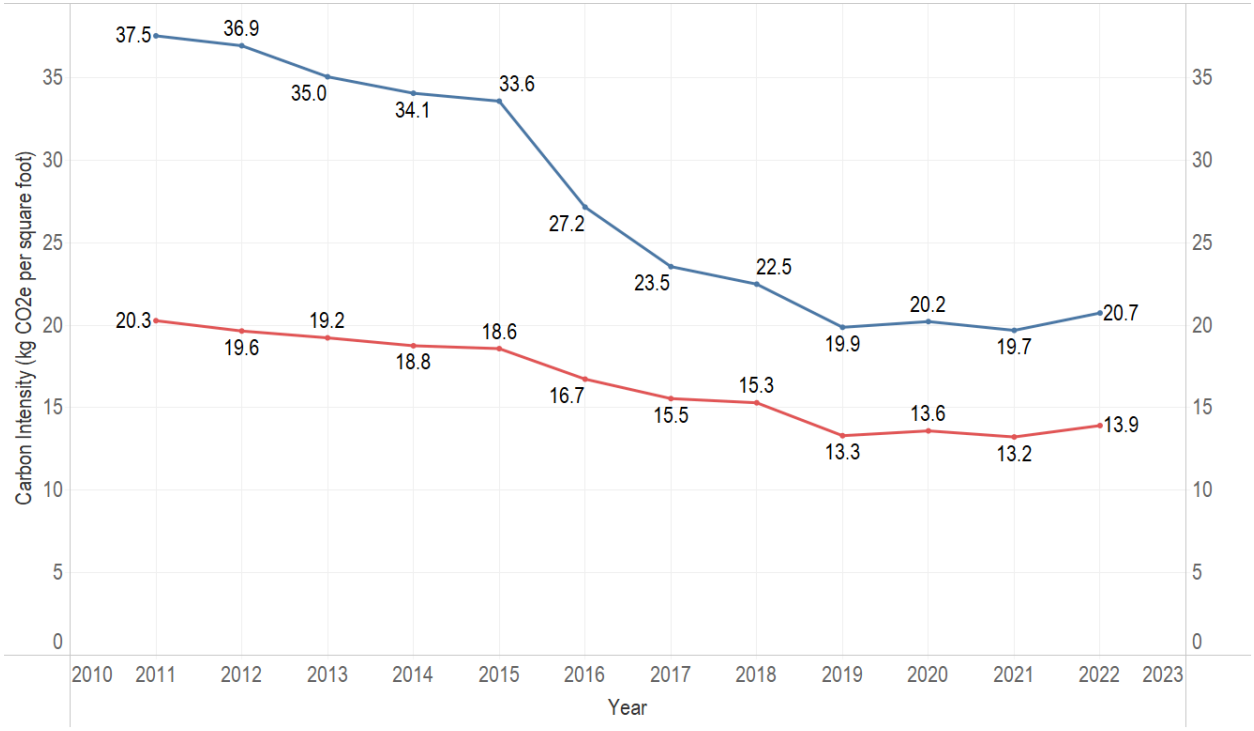
[13] City of Cambridge, "Building Energy Use Disclosure Ordinance," accessed October 20, 2024. https://www.cambridgema.gov/CDD/zoninganddevelopment/sustainabledevelopment/buildingenergydisclosureordinance.

Health care sector energy use and GHG trends

As mentioned above, site emissions have dropped 22%, from the baseline in 2011 of 473,182 MTCO2e to 367,311 MTCO2e in 2022. If energy consumption, grid mix, and EFs are held constant, the hospitals avoided almost 700,000 metric tons of site emissions over the 11 years following the 2011 baseline.

The sector's GHG emissions relative to the size of its buildings also decreased from 2011 to 2022, leading to a 43% improvement in its carbon intensity (CI).[14] Emissions decreased by 300,000 MTCO2e despite the 2.3 million square feet (ft^2) increase in gross floor area, a change of +10.3%.

Figure 1 below shows the sector's source and site CI in blue and red, respectively. These plots reveal that decreases in emissions outpaced the sector's building growth. Source CI declined by 45% as of 2022 from a 2011 baseline (37.5 to 20.7 kilograms of CO_2e per square foot of gross floor area [$kgCO_2e/ft^2$]), while site CI decreased by 32% (20.5 to 13.9 $kgCO_2e/ft^2$). The figure shows a significant decrease in both source and site CI between 2015 and 2019, after which it remained relatively constant.



[14] Carbon intensity (CI) for hospitals and other buildings refers to annual CO_2e emissions normalized to the gross floor area of a building. In keeping with the Boston Emissions Reduction and Disclosure Ordinance (BERDO), we express CI as kilograms of CO_2e per square foot of gross floor area, abbreviated as $kgCO_2e/ft^2$.

Figure 1 Annual source (blue line) and site (red line) carbon intensity for Metro Boston hospitals, 2011-2022, expressed as kilograms of carbon dioxide equivalent emissions per square foot of gross floor area

The hospitals' source and site energy use intensity (EUI) were essentially constant from 2011 through 2022. Source EUI peaked in 2011 (471.6 thousand British thermal units per square foot [kBtu/ft^2]), reached its lowest level in 2020 (427.7 kBtu/ft^2), and returned to circa 2014-2015 levels in 2022 (443.5 kBtu/ft^2). Annual site EUI exhibited a similar pattern. These findings show the annual amount of energy consumed changed in proportion to the hospitals' total floor area.

The presence of a steady EUI and a declining CI profile indicates the carbon reductions are largely attributable to an increase in cleaner energy types, either through the electric grid, fuel substitution, or renewable energy PPAs.

Decarbonization pathways

This section describes the approaches taken by HCWG members that produced the decarbonization progress presented above. We divide the approaches into four categories:

- Energy conservation
- On-site low-carbon energy production
- Contracts with low-carbon energy producers
- Private renewable energy contracts

Energy conservation

Every operation of a hospital building requires electric or heat energy. Energy conservation projects aim to optimize building performance by avoiding unnecessary energy consumption and ensuring adequate energy is available when and where it is needed.

Energy conservation takes many forms, including the following:

- Completing deferred maintenance
- Repairing broken equipment
- Sealing air, liquid, and steam leaks
- Cleaning heat exchangers and filters
- Aligning controls and schedules with occupancy
- Upgrading building envelopes
- Installing high efficiency lighting
- Replacing aged capital equipment with high efficiency equipment such as chillers, boilers, etc.

Timelines for projects like these range from months to years depending on the resources required, some of which have simple payback periods of 1-2 years. Some projects are eligible

for funding from the MassSave program, utilities, tax deductions, or tax credits, which shorten the payback period. Following implementation, facilities can maintain the gains by tracking and adapting to changes in energy consumption and use over time.

Local low-carbon energy sources

Generating electricity on site helps lower GHG emissions compared to grid electricity. Boston hospitals are now using gas-fired combined heat and power (CHP) systems (also referred to as co-generation[15] or “cogen”), solar panels, and other forms of renewable energy to lower their EUI and climate impact.

CHP systems generate electricity from the combustion of natural gas and use the resulting heat to produce steam or hot water.[16] These dual outputs achieve efficiencies of over 80%, which is 30% higher than conventional technologies.[17] In addition, on-site electric power generation avoids transmission loss, which accounts for about 5% of energy loss associated with grid electricity transmission.[18] Natural gas produces lower GHG emissions per unit of energy output than coal and oil. The carbon accounting of CHP plants is highly favorable compared to separate sources of electric and heat energy, because the GHG emissions from a single fuel (natural gas) are distributed between the electricity and heat outputs, resulting in lower CI for each compared to independent systems.

Metro Boston hospitals are reducing GHG emissions by shifting to CHP systems. CHP is an effective decarbonization method, but also ties a hospital to continued reliance on natural gas. Consequently, CHP systems may fall out of favor and be displaced by electricity-based generation of power and heating, especially if the share of renewable energy in the New England grid, and the capacity of transmission lines, increase. This future state is foreseeable as both Boston and Massachusetts continue to work toward a carbon-free electric grid. A tangible example of their commitment is the 806 MW offshore wind farm project that began delivering power to the New England grid in February 2024.[19,20] CHP plants may also be supplanted in the future by carbon-free on-site power generation systems, like fuel cells and waste stream energy recovery. For now, however, CHP is an important pathway for decarbonizing Boston’s hospitals.

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15 U.S. DOE, “Combined Heat and Power Basics,” accessed October 25, 2024. https://www.energy.gov/eere/iedo/combined-heat-and-power-basics.

16 OAR U.S. EPA, “What Is CHP?,” Overviews and Factsheets, August 19, 2015. https://www.epa.gov/chp/what-chp.

17 Ibid.

18 OAR U.S. EPA, “Data Explorer,” Data and Tools, March 2, 2020. https://www.epa.gov/egrid/data-explorer.

19 Mass.gov, “Vineyard Wind, America’s First Large-Scale Offshore Wind Farm, Delivers Full Power from 5 Turbines to the New England Grid,” accessed October 3, 2024. https://www.mass.gov/news/vineyard-wind-americas-first-large-scale-offshore-wind-farm-delivers-full-power-from-5-turbines-to-the-new-england-grid.

20 MGH, “Our Environmental and Sustainability Initiatives,” accessed October 20, 2024. https://www.massgeneral.org/environment-and-health/initiatives.

Turning now to solar, Mass General Brigham (MGB) operates 3,117 kW of photovoltaic in the greater Boston area including a 476 kW rooftop photovoltaic system atop a Massachusetts General Hospital (MGH) research building in Charlestown,[21] another 1,391 kW photovoltaic system on the campus of Newton Wellesley Hospital in Newton,[22] and a 1,250 kW system at the company's headquarters in Somerville. The Charlestown system is estimated to generate 568,000 kWh of power annually.[23] All systems are in front of the meter delivering energy to the regional grid. In 2024, MGH Waltham started operating a new behind-the-meter 576 kW system producing 666,864 kWh annually, and Brigham and Women's Faulkner Hospital will soon start the construction of a 1,200 kW system producing 1,407,839 kWh annually.

Low and zero-carbon energy contracts

Low-carbon and zero-carbon electricity and steam contracts are another decarbonization pathway for hospitals. Unlike many PPAs and conventional offsets, these contracts physically deliver energy to the buyer's regional electric grid or district steam system. For this reason, these vehicles are termed direct-delivery renewable energy purchases.

MGB started purchasing some of its power from hydroelectric sources, where the flow of water is used to spin a turbine and produce electricity.[24,25] In the spring of 2017, MGB announced the purchase of energy and Class I RECs representing 75% of the capacity of a 28.8 MW wind farm in Antrim, New Hampshire.[26,27] This wind energy purchase is expected to offset MGB electricity grid consumption through at least 2039.

In 2006, MGB began using "green steam" for heating buildings and hot water, along with other purposes like sterilization.[28] This recycled steam is a byproduct from the Vicinity cogeneration station in Kendall Square and is delivered by a pipeline owned by MGB.[29,30] BMC also utilizes

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21 Ibid.
22 Mass General Brigham, "Commitment to the Environment," accessed October 19, 2024. https://www.nwh.org/about-us/commitment-environment.
23 621 Energy, "Massachusetts General Hospital," accessed October 3, 2024. https://www.621energy.com/mgh.
24 MGH, "Energy Infrastructure at MGH: Only 1.8 Kilograms of CO2 Emissions Per Square Foot," accessed October 20, 2024. https://www.massgeneral.org/news/hotline/htl042321/energy-infrastructure-at-mgh.
25 U.S. DOE, "Hydropower Basics," accessed October 20, 2024. https://www.energy.gov/eere//hydropower-basics.
26 MGH, "Energy Infrastructure at MGH: Only 1.8 Kilograms of CO2 Emissions Per Square Foot," accessed October 19, 2024. https://www.massgeneral.org/news/hotline/htl042321/energy-infrastructure-at-mgh.
27 Healthcare Design, "Partners HealthCare Announces Contract with Atrium Wind Energy," accessed October 19, 2024. https://healthcaredesignmagazine.com/news/news-projects/partners-healthcare-announces-contract-antrim-wind-energy/.
28 MGH, "Energy Infrastructure at MGH: Only 1.8 Kilograms of CO2 Emissions Per Square Foot," accessed October 24, 2024. https://www.massgeneral.org/news/hotline/htl042321/energy-infrastructure-at-mgh.
29 Ibid.
30 Vicinity Energy, "Our history and future: Vicinity Energy in Kendall Square," accessed October 20, 2023. https://www.vicinityenergy.us/blog/our-history-vicinity-energy-in-kendall-square/.

green steam through a contract with Veolia Energy.[31] BMC reported a substantial decrease in carbon emissions in 2016, with 20% of that decrease attributed to the switch to green steam.[32]

Offsets and renewable energy contracts

PPAs and virtual PPAs (VPPAs) are funding mechanisms for renewable energy projects which displace the development of new energy projects that fossil fuels would otherwise have powered. With a PPA, customers have a contract with a third-party developer that provides energy from a renewable energy project, like solar panels or wind turbines.[33] The contract includes that the customer will purchase electricity generated from the renewable system for a predetermined period, often at a stable and competitive rate. This arrangement enables the customer to access renewable energy without the upfront costs of system installation and maintenance. With PPAs, electricity is physically delivered to the customer through the electric grid, meaning the customer and the renewable energy project must be located in the same grid region.[34]

VPPAs, however, do not require customers and renewable energy projects to be located in the same grid region. Instead of physically delivering electricity, this is a financial engagement where the customer is provided RECs associated with a renewable energy project, which can be used to offset Scope 2 emissions.[35] Both PPAs and VPPAs can offset an organization's direct or indirect GHG emissions but do not affect its energy consumption.

Starting in January 2016 and continuing through 2022, MGB offset the remaining electricity-related GHG emissions by retiring the RECs from an additional zero-emission, certified low-carbon source of hydroelectric power. An additional significant VPPA investment by MGB and others was announced in November 2024.[36]

BMC offset the GHG emissions associated with its electricity consumption by signing a 20 MW VPPA with a solar electric project in North Carolina. The solar project began commercial operation in March 2017, and is part of BMC's collaboration with the Massachusetts Institute of Technology (MIT) and the nonprofit Post Office Square Redevelopment Corp.[37] Through this

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31 BMC, "Institutional Master Plan 2021-2031, Boson Medical Center." https://www.bmc.org/sites/default/files/About_Us/BMC_IMP_2021.pdf.

32 The Commonwealth Fund, Greening the Health Care Safety Net," accessed October 20, 2024. https://www.commonwealthfund.org/publications/case-study/2023/aug/greening-health-care-safety-net.

33 U.S. DOE, Better Buildings, "Power Purchase Agreement," accessed October 24, 2024. https://betterbuildingssolutioncenter.energy.gov/financing-navigator/option/power-purchase-agreement.

34 Ibid.

35 U.S. EPA, "Introduction to Virtual Power Purchase Agreements Webinar." https://www.epa.gov/sites/default/files/2016-09/documents/webinar_kent_20160928.pdf.

36 MGB, "Mass General Brigham Collaborates with Boston and Cambridge Institutions to Invest in Wind and Solar Power." https://www.massgeneralbrigham.org/en/about/newsroom/press-releases/mgb-invests-in-wind-solar-power.

37 BMC, "Institutional Master Plan 2021-2031, Boston Medical Center." https://www.bmc.org/sites/default/files/About_Us/BMC_IMP_2021.pdf.

VPPA contract, BMC receives RECs from its investment in Summit Farms, a solar farm in North Carolina.[38] BMC negotiated a 25-year contract with predictable annual increases and mitigated the risk of investing in a new power source.[39] With this investment, BMC has offset about 100% of its electricity use on campus.[40] To make the financials work, BMC arbitraged the project RECs for Green-e RECs, which they retired starting in June 2017.

Looking ahead: 2030 and beyond

Progress against business-as-usual projections

This section compares the sector's emissions with business-as-usual (BAU) trends and future projections, focusing on site emissions because, without factoring in progress against losses included in source emissions, facilities are responsible for taking more action to achieve reductions. Figure 2 below shows annual site emissions for 2011 through 2022 organized by energy type, along with projections of annual emissions to reach an overall 50% reduction in 2030 and trendlines for two BAU scenarios.

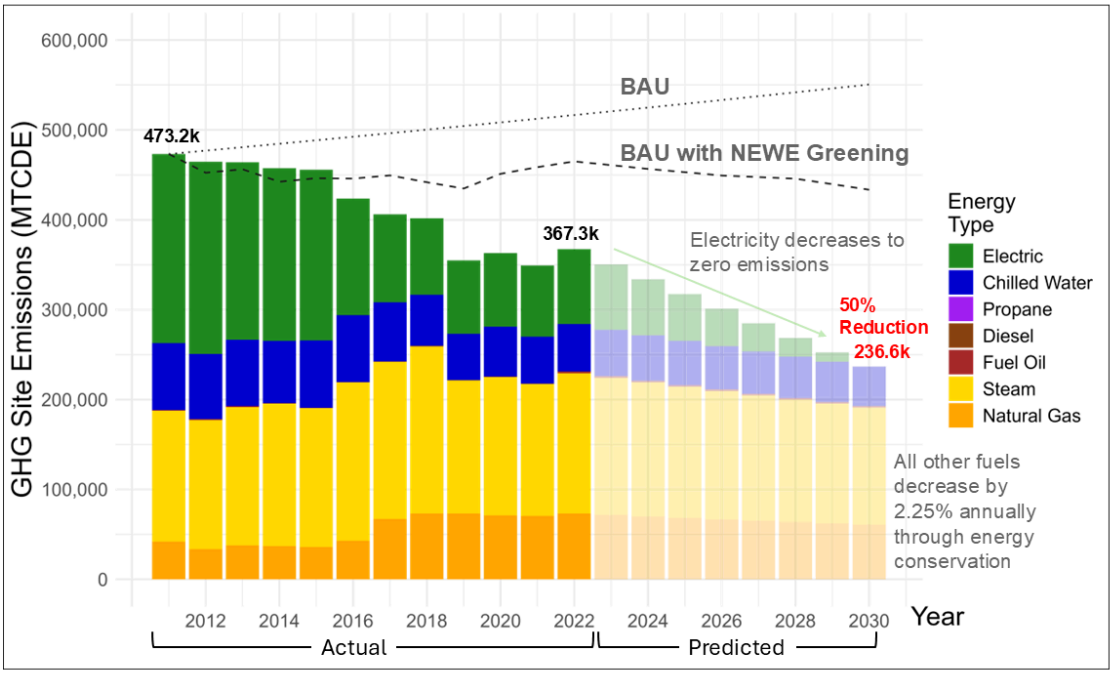

Figure 2 Annual site emissions and projections by energy type for Metro Boston hospitals, 2011-2030

[38] A Better City, "A better city-facilitated joint solar power purchase agreement," accessed October 25, 2024. https://www.abettercity.org/news-and-events/blog/a-better-city-facilitated-joint-solar-power-purchase-agreement.
[39] Ibid.
[40] BMC, "Institutional Master Plan 2021-2031, Boston Medical Center." https://www.bmc.org/sites/default/files/About_Us/BMC_IMP_2021.pdf.

The figure also presents two BAU scenarios. In the first, hospitals do not make decarbonization efforts (a 0.8% annual increase in energy usage is assumed), and the New England eGRID subregion (NEWE) electric grid mix remains the same (e.g., is not improved by an increasing share of renewable energy). In this case, 2022 emissions would have been 516,500 MTCO2e (41% greater than the actual 2022 value of 367,300 MTCO2e), and the 2030 projection would have been 550,500 MTCO2e, which is over double the 50% reduction goal of 236,000 MTCO2e.

In the second BAU scenario, hospitals still do not make decarbonization efforts, and energy consumption increases by 0.8% per year, but the EFs mirror the percentage change in the NEWE grid. Here, 2022 emissions would have been 465,000 MTCO2e, instead of the actual value of 367,300 MTCO2e, which is 26% smaller. The 2030 projection with this BAU would be 433,500 MTCO2e (84% greater than the 50% reduction goal of 236,000 MTCO2e).

Figure 2 also breaks down emissions by energy type. The figure reveals that emissions from electricity consumption steadily decrease over time, which can be attributed to renewable sources contributing more to the electric grid mix. Natural gas makes up a larger share of the fuel mix during the 2017-2022 period than the 2011-2016 period, in part because natural gas is also being used to generate electricity through CHP.

Figure 2 shows one possible path to achieve 50% of 2011 GHG emissions. In this scenario, the GHG emissions from electricity are eliminated, and the GHG emissions from all other energy types each decrease by 2.25% annually. While reducing all fossil fuel emissions by 2.25% each year may be feasible for some hospitals, others may find this prescribed strategy challenging if, for example, they have introduced CHPs and thereby see an increase in the share of natural gas in the fuel mix. Therefore, we also note that alternate distributions of emissions reductions from fossil fuels could be implemented to achieve the goal of reducing overall emissions. The EF for natural gas (53.11 $kgCO_2e/MWh$) is lower than the EFs for diesel (74.21 $kgCO_2e/MWh$), fuel oil (74.21 $kgCO_2e/MWh$), and propane (64.25 $kgCO_2e/MWh$), so reductions in consumption of fuels other than natural gas will offer greater emissions reduction per kilogram of fuel. However, the share of diesel, fuel oil, and propane collectively made up 0.4% of the total site energy consumption in 2022. Thus, there are limits to the achievable emissions reductions from reducing combustion of other fuels, and a different approach might be needed to achieve the GHG emissions reduction goal. A benefit of CHPs to consider is the reduction in steam energy consumption. Steam currently makes up the largest energy consumption of all energy types for this group of Boston hospitals, accounting for 38.2% of site energy consumption in 2022. Using CHPs or other more efficient technology to reduce steam consumption could also contribute to achieving the GHG emissions reduction goal.

Greening of the grid contributes to annual emissions reductions

Renewable energy projects have gained a larger share of the New England electricity supply market in recent years. In 2011, hydroelectric, solar, and wind projects accounted for 6.4% of electricity generated within NEWE.[41,42] By 2022, these three renewable sources doubled to 13% of the market share.[43] In addition, renewables and natural gas are phasing out the system's remaining coal-fired and oil-fired electric generating units. Combined, coal and oil represented only 2% of the NEWE fuel mix in 2022,[44] compared with 12% of the mix in 2011.[45]

An upshot of these fuel mix changes is that the GHG EF for the NEWE grid electricity decreased 26% from 330 $kgCO_2e/MWh$ in 2010[46] to 245 $kgCO_2/kWh$ in 2022.[47] The EF affects Scope 2 emissions for facilities that draw electric power from the grid. Changes to this EF are independent of hospital operations and represent a BAU scenario.[48]

Although the NEWE generates approximately 290,000 MWh of power daily,[49] this regional grid's fuel mix has a minor effect on GHG emissions for the Metro Boston hospitals included in this analysis. Only Tufts Medical Center consumed NEWE electricity for the entire study period; other organizations supplemented or replaced energy from the local electric grid with market-based energy contracts that have their own EFs.

GHG emissions from electricity consumption account for about half of this sector's total emissions. Thus, the greening of the NEWE grid has caused – and is expected to continue to cause – GHG emissions in the sector to decline further, as projected in Figure 2. Including the grid's EF effects, site GHG emissions for the sector in 2022 were 105,900 MTCO2e lower than in 2011, a decrease of 22%.

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[41] "Year 2010 eGRID 9th edition Version 1.0 Boiler, Generator, Plant, State, PCA, eGRID Subregion, NERC Region, U.S., and Grid Gross Loss (%) Data Files," downloaded from: U.S. Environmental Protection Agency, "Historical eGRID Data," filename: 'eGRID2010_Data.xls'. https://www.epa.gov/egrid/historical-egrid-data.

[42] This value is based on 2010 eGRID data, as U.S. EPA only publishes eGRID data for select years and did not publish 2011 data.

[43] "eGRID2022 Unit, Generator, Plant, State, Balancing Authority Area, eGRID Subregion, NERC Region, U.S., and Grid Gross Loss (%) Data Files," downloaded from: U.S. Environmental Protection Agency, "Download Data, eGRID with 2022 Data." https://www.epa.gov/egrid/download-data.

[44] Ibid.

[45] "Year 2010 eGRID 9th edition Version 1.0 Boiler, Generator, Plant, State, PCA, eGRID Subregion, NERC Region, U.S., and Grid Gross Loss (%) Data Files," downloaded from: U.S. Environmental Protection Agency, "Historical eGRID Data," filename: 'eGRID2010_Data.xls'. https://www.epa.gov/egrid/historical-egrid-data.

[46] "Year 2010 eGRID 9th edition Version 1.0 Boiler, Generator, Plant, State, PCA, eGRID Subregion, NERC Region, U.S., and Grid Gross Loss (%) Data Files," downloaded from: U.S. Environmental Protection Agency, "Historical eGRID Data." https://www.epa.gov/egrid/historical-egrid-data.

[47] U.S. EPA, "eGRID Summary Tables 2022." https://www.epa.gov/system/files/documents/2024-01/egrid2022_summary_tables.pdf.

[48] The business-as-usual scenario is a counterfactual in which the hospitals do not lower their carbon intensity, but renewable energy sources gain a larger share of the New England region's electric grid.

[49] Estimated from the annual generation quantity in 2022, from: U.S. EPA, "Data Explorer," accessed October 24, 2024. https://www.epa.gov/egrid/data-explorer.

With most states having coastal access, the New England grid has great potential for renewable energy projects that will continue to reduce EFs, such as the Vineyard Wind offshore wind project off Martha's Vineyard.[50]

Commitments and conclusions

More than 200 U.S. health care organizations, including 139 representing over 900 hospitals, have signed the White House/HHS Health Sector Climate Pledge, committing to reduce their GHG emissions.[51] Specifically, signatories make a voluntary commitment to reduce GHG emissions by 50% by 2030 and reach net-zero emissions by 2050. All six of the organizations included in this analysis have signed the pledge.

MassHealth has taken a significant step in addressing climate change by mandating that all 55+ acute care hospitals in Massachusetts using Medicaid funds begin tracking and reporting their Scopes 1 and 2 GHG emissions.[52] This will include on-site fuel use, anesthetic gases, vehicle fleet emissions, and purchased energy. Hospitals must report this data starting in 2025, which will be verified through a state-approved third party.

This policy positions Massachusetts as a leader in decarbonizing the health care sector and aligns with statewide emissions reduction goals. Massachusetts will be the first state to require hospitals to track and report GHG emissions through its Medicaid program. By directly linking a key source of public health care funding to climate accountability, this policy paves the path forward for other states and the federal government to potentially follow, and emphasizes health care's critical role in leading on climate action.

Boston's health care organizations have made enormous strides toward decarbonization of their facilities, and they deserve praise for the leadership position they hold in the national landscape of this work. However, much work remains to be done, and policymakers will need to support health care organizations in pursuing deeper emissions reductions in the years ahead. Mitigation solutions that create additional facility resilience, such as battery storage, geothermal, and solar microgrids, should be prioritized where feasible.

Taking inspiration from the innovative MassHealth program, state and local health care- and climate-focused policymakers should identify existing tools, regulatory frameworks, and programs that can be leveraged to support the health sector. This can be driven, in part, by deliberate inclusion of health sector voices as part of climate and decarbonization stakeholder

[50] Vineyard Wind, "Vineyard Wind," accessed October 25, 2024. https://www.vineyardwind.com/vineyardwind-1.
[51] U.S. HHS, "Health Sector Commitments to Emissions Reduction and Resilience," accessed October 24, 2024. https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-change-health-equity/actions/health-sector-pledge/index.html.
[52] COMMBUYS, "Bid Solicitation:Rate Year 2025 Acute Hospital Request for Applications," accessed December 12, 2024. https://www.commbuys.com/bso/external/bidDetail.sdo?docId=BD-25-1039-EHS01-ASHWA-107272&external=true&parentUrl=close.

engagement, and in formal stakeholder engagement for all public clean energy planning processes. For example, The City of Boston established a Health Institution Working Group for health sector voices within the Building Emissions Reduction and Disclosure Ordinance (BERDO) implementation process.

The contractual, regulatory, technological, and economic challenges to achieving the full decarbonization between 2030 and 2050 envisioned in the goals set by the City of Boston and Commonwealth of Massachusetts are significant. To overcome them, Boston's health care leaders must build partnerships with energy providers, governments, and each other to achieve 2030 goals while developing long-term strategic plans for deeper decarbonization in the years to follow.

About the Boston Green Ribbon Commission
The mission of the Boston Green Ribbon Commission (GRC) is to accelerate the implementation of the City's Climate Action Plan by convening, organizing, and enabling leaders from Boston's key sectors. The City of Boston is committed to achieving net-zero carbon energy sources by 2050, even as the city grows, as well as ensuring protection from heat and flooding. The GRC provides a forum for representatives of the private sector and the City to discuss, plan, and act on the opportunities, challenges, ideas, and requirements of preparing Boston to meet the imperatives of climate change.

About Health Care Without Harm
Health Care Without Harm seeks to transform health care worldwide so that it reduces its environmental impact, becomes a community anchor for sustainability, and a leader in the global movement for environmental health and justice.

Health Care Without Harm's work in Boston is supported by the Barr Foundation.

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