UMass Chan
MEDICAL SCHOOL

DECARBONIZATION PLAN 2024

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Climate change and its impacts on health

Human and planetary health are inextricably linked.

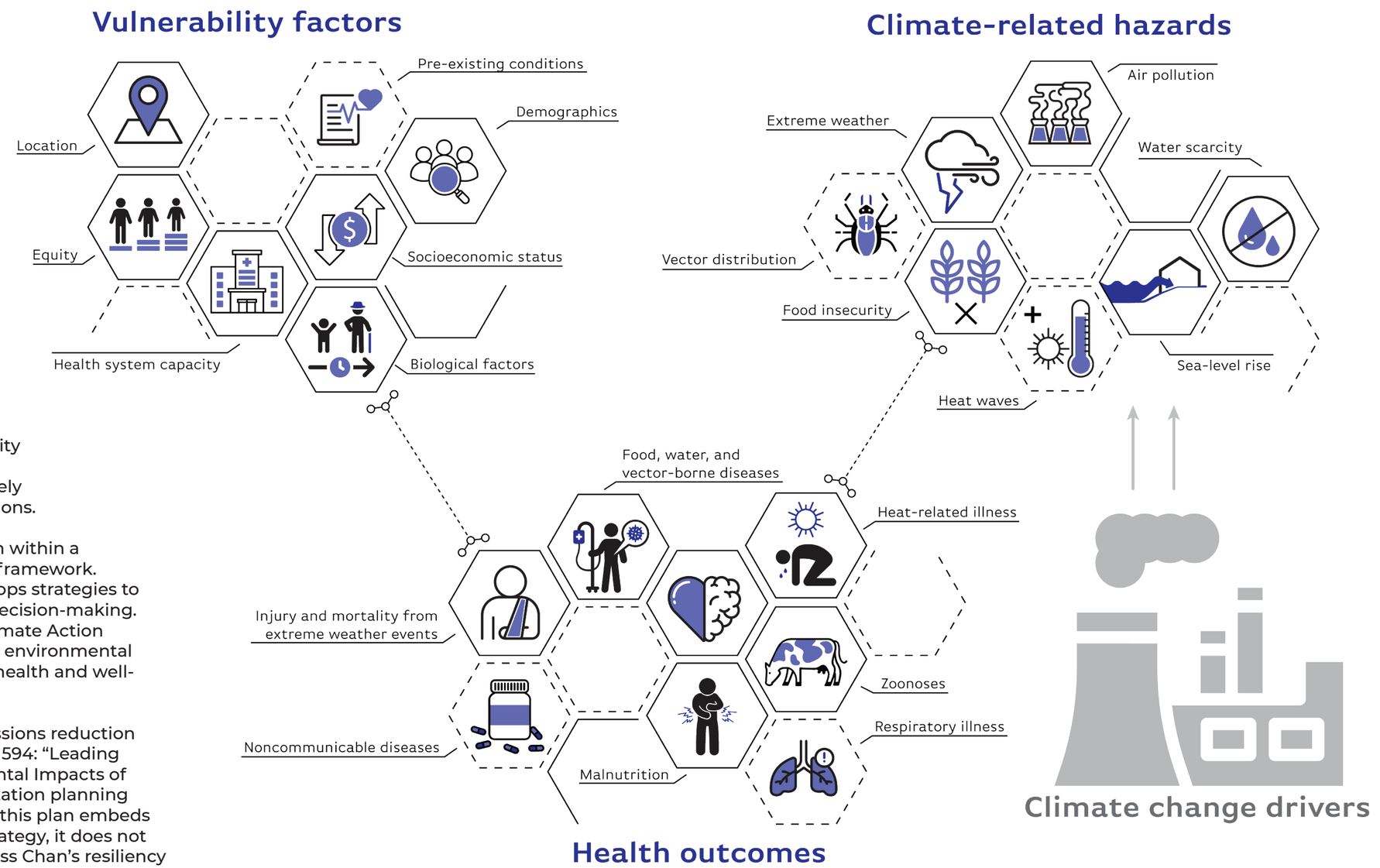
Climate change impacts health in myriad ways—increasingly frequent extreme weather events, the disruption of food systems, increases in food-, water- and vector-borne diseases, and mental health issues all affect the well-being of our communities.

Furthermore, climate change undermines many of the social determinants of health, such as livelihoods, equality and access to health care and social support structures. These climate-sensitive health risks are disproportionately felt by the most vulnerable and disadvantaged populations.

UMass Chan integrates sustainability and climate action within a comprehensive environmental, social, and governance framework. By adopting a holistic perspective, the institution develops strategies to assess the environmental and social consequences of decision-making. The UMass Chan Medical School's Sustainability and Climate Action Plan for 2021–2026 outlines significant commitments to environmental sustainability, aligning with its mission to enhance the health and well-being of diverse communities.

These priorities, coupled with ambitious statewide emissions reduction targets set out through Massachusetts Executive Order 594: "Leading by Example: Decarbonizing and Minimizing Environmental Impacts of State Government," are part of what drove a decarbonization planning effort that began in 2022 and concluded in 2024. While this plan embeds resiliency as a key consideration for decarbonization strategy, it does not serve as a resiliency plan, nor is it representative of UMass Chan's resiliency efforts.

Figure 1. — Climate change and health impacts



Source: World Health Organization

UMass Chan facilities

The largest sources of greenhouse gas emissions at UMass Chan are through building operations.

UMass Chan currently operates a central utility plant (CUP) that uses natural gas to satisfy heating, cooling, and electrical loads on campus, with diesel and No. 6 oil as back-up fuels. Resiliency is embedded in the current configuration, with the central utility plant as the primary source of power generation. Resiliency against utility outages via power and fuel supply redundancy is crucial for continued operations of UMass Chan's research and UMass Memorial Health's clinical care facilities.

When focusing on decarbonization efforts, UMass Chan's options are complicated by a need to maintain operational continuity during utility outages, high energy demand, and a reliance on delivering the utilities necessary to maintain the demanding environmental conditions required for healthcare and research facilities.

The decarbonization planning process

UMass Chan recognized from the start that the road to a decarbonized campus would require a comprehensive array of solutions.

A rich, widely engaging stakeholder process was a critical component of ensuring that the outcome reflected the resources of deep knowledge, wisdom, and perspectives that make up the campus community.

In November 2022, the decarbonization planning process was initiated by a core project management team comprising UMass Chan staff, Arup, Waldron Engineering, and GreenerU. Throughout the planning process, UMass Chan faculty, staff, students, and UMass Memorial Health facilities leadership were actively engaged in a series of task force and internal meetings to evaluate the operational, technical, and directional challenges and opportunities associated with decarbonization.

Goal- and priority-setting

One of the key elements of the decarbonization planning process was establishing a set of criteria by which to weigh decision-making. Based on discussions with the task force and a weighted ranking exercise with the project management team, priorities and goals emerged to assist UMass Chan in striking a balance in developing its path to decarbonization:

- **Scope 1**—Strategies must address reducing Scope 1 emissions, which account for the vast majority of campus emissions, including technologies that displace current on-site fossil fuel usage.
- **Resilience**—Resilience is mission-critical for UMass Chan, which includes maintaining continuity of critical operations independent of the grid.
- **Stewardship**—We must make financially responsible recommendations in alignment with the mission of the University.
- **Integration**—New systems must be able to integrate with the campus over time, which involves feasible and technical pathways for integration of new technology into existing campus systems.
- **Efficiency**—Energy efficiency is the "first fuel;" reducing energy consumption to the greatest extent possible is a key component of emissions mitigation.
- **Innovation**—UMass Chan values responsible, informed innovation in the use of technologies that are commercially viable, allowing for flexibility to make decisions as technologies mature.
- **E.O. 594**—Alignment with the Commonwealth's Executive Order 594 in support of the Commonwealth's 2050 carbon reduction target is a responsibility of the University.

Figure 2. — UMass Chan's decarbonization goals and priorities

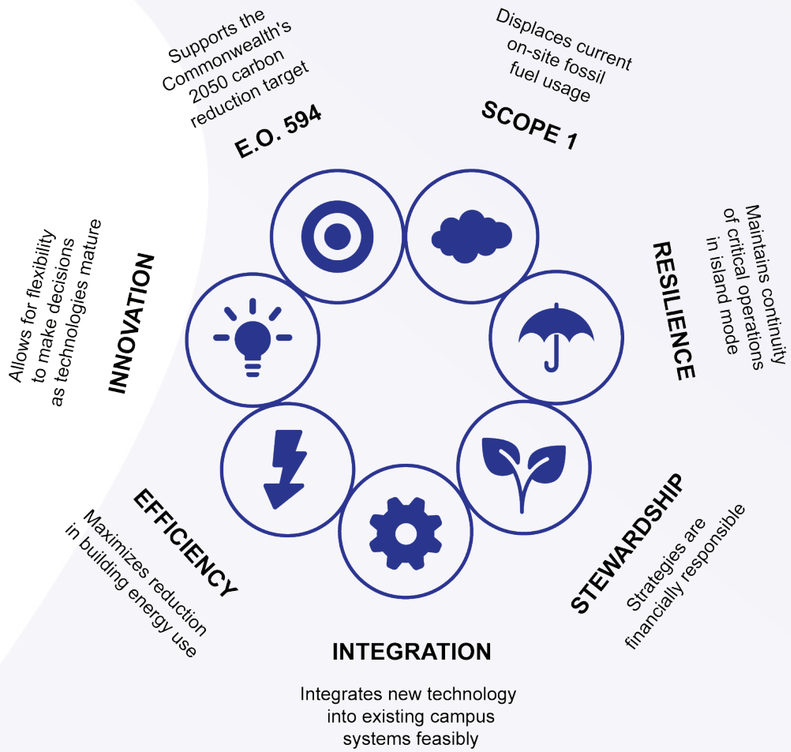
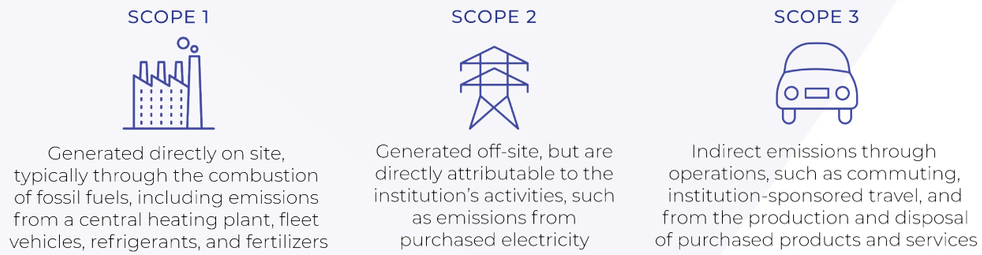


Figure 3. — Sources of greenhouse gas emissions

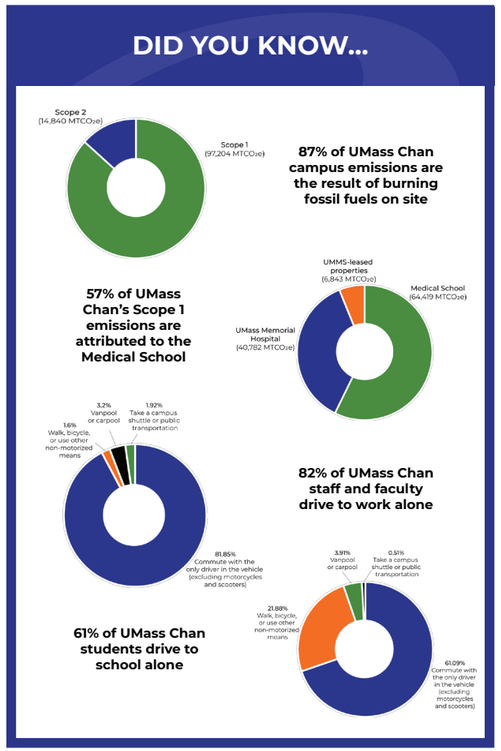


Campus engagement

UMass Chan's exploration of decarbonization pathways provided a unique opportunity to share campus sustainability efforts more broadly and gather together groups of stakeholders to learn more and get involved.

Open House

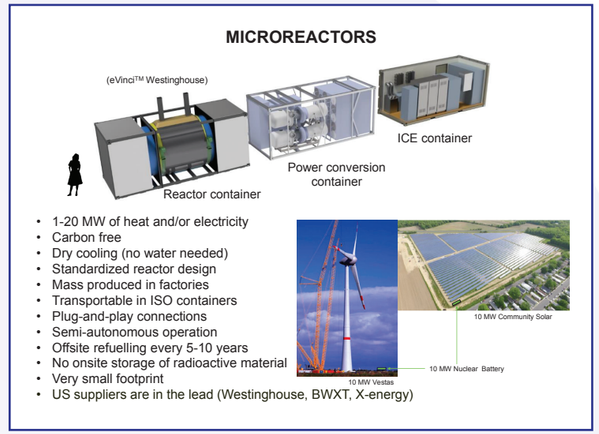
UMass Chan hosted a campus-wide open house on January 19, 2023, from 9 a.m. to 3 p.m. at the Albert Sherman Center Café. The event featured opportunities to weigh in on key sustainability and decarbonization priorities on campus, discuss the decarbonization planning process with Arup and GreenerU, and get free cookies, coffee, and wildflower seed giveaways.



ENGAGING IN DECARBONIZATION *An open house in January 2023 at the Albert Sherman Center Café provided free coffee, cookies, and opportunities to engage with staff and consultants on decarbonization planning.*

Earth Month webinar series

In April 2023, UMass Chan hosted a webinar series on potential decarbonization pathways using alternative fuel options such as micronuclear, electrification, hydrogen, and biofuels. Guest speakers included Jacopo Buongiorno, Ph.D., Massachusetts Institute of Technology; Bryan Pivovar, Ph.D., National Renewable Energy Laboratory; Chris Lewis, CEM, GreenerU; and Tom Twist, Sustainability Manager, Bates College. These webinars provided the latest information on the safety, viability, and availability of emerging alternative fuel sources that may eventually reduce or eliminate the need for fossil fuels.

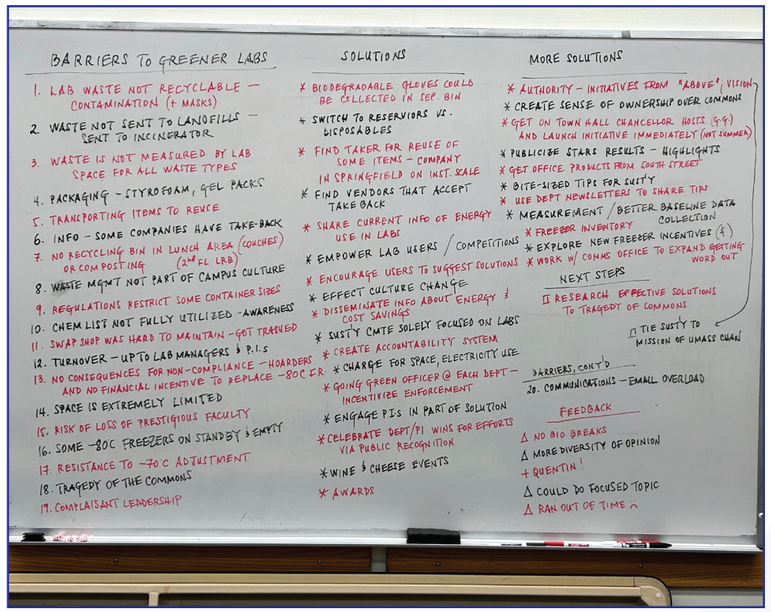


WEBINAR SERIES *Above and above right: Jacopo Buongiorno, Ph.D. of MIT shared a presentation on the viability of micronuclear energy as a clean power source. Right: poster for UMass Chan's Earth Month webinar series.*

Green Labs

Green Labs

Research laboratories can be major energy users, requiring a balance of safety with a need for energy conservation in reconditioning fresh air to meet the existing room temperature. In April and July 2023, individuals representing environmental health and safety, capital planning, laboratory users, and campus sustainability gathered to identify barriers and potential solutions to greener laboratories on the UMass Chan campus. Three broad categories of focus emerged: energy use, waste management, and sustainability culture.



GREEN LABS *Two sessions with lab users, environmental health and safety team members, and other stakeholders generated a set of barriers and solutions to more sustainable laboratory practices on campus.*

Decarbonization roadmap

Extensive research, exploration, discussions, and lengthy reporting led to a strategic pathway for decarbonization that involves several steps at UMass Chan.

Using established goals and priorities (see page 5) against which to weigh its decarbonization options, UMass Chan worked iteratively to develop a framework for a technical and operationally feasible approach to decarbonization that balanced its priorities of emissions reduction, campus resiliency, financial stewardship, efficiency, and more.

The importance of steam

When focusing on decarbonization efforts, UMass Chan's options are challenged by a need to maintain operational continuity during grid electrical outages, high energy demand, and a reliance on delivering the utilities necessary to maintain the demanding environmental conditions typical for healthcare and research facilities. A steam system can effectively provide process steam for sterilization and serve as an area-wide humidifier which can be adjusted to achieve necessary levels.

STEP ZERO: Maintain steam system

UMass Chan currently operates a central utility plant (CUP) that uses natural gas to generate steam for the heating, cooling, and electrical loads on campus, with diesel and oil as back-up fuels. Only 9% of UMass Chan's electricity comes from a utility supplier.

Resiliency is embedded in the current configuration, with the central utility plant serving as the primary source of power generation. Resiliency against power outages via power supply redundancy is crucial for continued operations at UMass Chan's research facilities and UMass Memorial's clinical care facilities.

Buildings and their associated systems account for all but a fraction of a percent of Scope 1 emissions on campus. UMass Chan's central utility plant serves all eight buildings on the main campus, including the recently completed New Education and Research Building (NERB).

The plant distributes chilled water and medium-pressure steam (MPS) to all of the connected buildings via utility tunnels and subsurface utilities.

Steam is critical for essential functions such as sterilization and humidification on campus. The necessity of steam challenges a campus-level transition to a low-temperature hot water system in support of heat pumps, as it would require additional new infrastructure. This new infrastructure would come at a significant cost and disruption to campus operations, and continued maintenance would still be required for the steam distribution loop. For these key reasons, UMass Chan has chosen to retain the existing steam distribution loop as part of its decarbonization strategy.

STEP ONE: Implement energy-conservation measures

Opportunities exist at the campus and building level to improve energy efficiency and operations to lower energy use intensity and reduce the total amount of energy required to decarbonize. A study performed by B2Q in 2016 via the Massachusetts Division of Capital Asset Management and Maintenance (DCAMM) found that a series of energy-efficiency measures could be deployed across the UMass Chan campus, regardless of future decarbonization pathways chosen:

- Performing a deep energy retrofit of Medical School mechanical systems, including LED lighting retrofits, implementing and adjusting temperature zone setpoints and occupancy sensors, replacing leaking valves, and retrofitting ventilation units
- Performing a similar deep energy retrofit of hospital mechanical systems
- Reducing air change rates, installing chilled beams, and retrocommissioning HVAC sequence of operations in the Albert Sherman Center, Lazare Research Building, Benedict Building, and the Lakeside Wing

STEP TWO: Implement on-site solar

UMass Chan worked with subcontractor Solventerra to identify available and feasible spaces to install on-site solar photovoltaic (PV) arrays. Data indicates a total PV potential that could offset a substantial portion of UMass Chan's electrical purchases from National Grid. That said, 91% of UMass Chan's electricity supply is generated on site through its existing central utility plant, which would not be offset through on-site renewable energy generation.

STEP THREE: Switch fuels

Eliminating dependence on natural gas for steam generation will be one of the final steps in UMass Chan's decarbonization journey to reduce or eliminate Scope 1 emissions. At present, most alternative fuel sources would not meet energy needs on campus—but alternative options to fossil fuels are constantly evolving. UMass Chan looked at the following:

- **Biomass**. Also known as ethanol, biodiesel, and biofuels, biomass is renewable organic material that comes from plants and microorganisms. Burning biomass still releases Scope 1 greenhouse gas emissions, though to a lesser extent than do fossil fuels. Supply and storage capabilities would be inadequate to meet UMass Chan's energy needs.
- **Green hydrogen**. "Green" hydrogen is produced by using renewable energy to power the electrolysis of water. While this is a fully clean fuel source that can be compressed and stored in tanks for a long time, available supply and volume required to power UMass Chan's buildings are major challenges to green hydrogen as a fuel source.
- **Micronuclear**. Small modular and micronuclear reactors are capable of generating both electricity and thermal energy for electricity and heat. They can operate for years without refueling. Commercial availability, siting requirements, financial feasibility, and other limitations are present challenges to pursuing micronuclear.
- **Electrification**. Electrifying campus heating and cooling may be a strategy to reduce demand for alternative fuels. Heat pumps and/or electrical chillers are mature technologies that can be sourced through renewables, though this will increase demand through National Grid, UMass Chan's electricity provider, and would not provide the resiliency and reliability that the current CUP provides.

UMass Chan's path to decarbonization

Implement energy-conservation measures

Measures such as LED lighting upgrades and controls, implementing and adjusting temperature zone setpoints and occupancy sensors, replacing leaking valves, reducing air change rates, installing chilled beams, and retrofitting ventilation units help reduce energy demand across campus. Opportunities to conserve energy are monitored and implemented continuously to fine-tune and make the most efficient use of equipment on campus.

Implement on-site solar

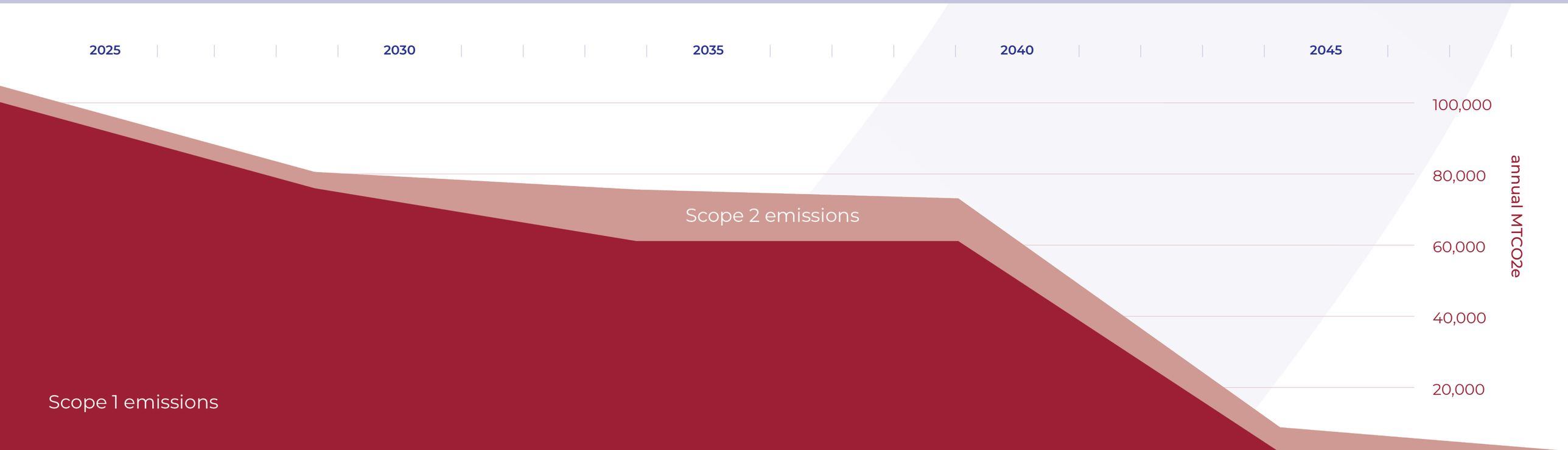
UMass Chan is investigating several on-site locations to install solar arrays.

Switch fuels

To eliminate Scope 1 emissions, UMass Chan will need to power its campus with a carbon-free fuel source. UMass Chan will continue to monitor developments in cleaner fuel options as technologies continue to mature to market readiness.

Explore offsets

Purchasing carbon offsets and/or renewable energy certificates (RECs) are a solution to "zeroing" any residual emissions the campus may still be responsible for.



Stakeholders

The project management and implementation team

The project management team was responsible for driving the decarbonization effort forward, serving as the main point of contact for the consulting firms, developing and reviewing drafts and deliverables, and ensuring there was strategic buy-in from across campus.

David Flanagan, Deputy Executive Vice Chancellor for Facilities Management
Josh Fleming, Senior Director of Facilities Maintenance
Dave MacNeil, Senior Mechanical Project Manager
Brian Pasquale, Senior Director of Engineering and Infrastructure
Suzanne Wood, Associate Director of Sustainability and Campus Operations
Kortni Wroten, Sustainability and Energy Manager

The task force

The decarbonization task force served as representatives of the UMass Chan Medical School community and the Commonwealth of Massachusetts, weighing in on the overarching project priorities and goals for decarbonization and striking a balance between achieving greenhouse gas emissions reduction targets and maintaining the level of service, safety, and continuity of a major regional medical care facility.

Edward Allison, Facilities Project Manager
Jeremy Careau, Senior Electrical Project Manager
Eden Diamond, Leader of the Student Climate Coalition
Josh Fleming, Senior Director of Facilities Maintenance
Mary Flynn, Assistant Professor of Family Medicine and Community Health
Eric Friedman, Director, Leading by Example, Massachusetts Department of Energy Resources
Bruce Hjort, Assistant Director of Energy Resources
Jonathan Holdorf, Assistant Professor of Medicine of Pulmonology
Betsy Isenstein, Director, Energy and Sustainability, Massachusetts Division of Capital Assets Management and Maintenance (DCAMM)
David Kelley, Co-Gen Engineer III Operations Lead
Veronica Labelle, Architectural Project Manager
Krista Lillis, Energy Program Deputy Director, Massachusetts Division of Capital Assets Management and Maintenance (DCAMM)
Roger Luckman, retired faculty
Kathleen Mondor, Director of Perioperative Service, UMass Memorial Health
Rick Perro, Senior Director of Data Management Services
Sambra Redick, Senior Research Scientist
Matthew Robinson, Senior Electrical Project Manager
Elizabeth Waltman, student
Suzanne Wood, Associate Director of Sustainability and Campus Services
Kortni Wroten, Sustainability and Energy Manager

The technical team

The technical team was made up of facilities employees and consultants with expertise in engineering, maintenance, and operations, and were responsible for ensuring that the nuances of UMass Chan's physical plant were reflected in both the baseline assessment and the final set of recommendations.

UMass Chan Medical School

Ed Allison, Facilities Project Manager
Joe Collins, Senior Director of Energy Resources
Brian Duffy, Senior Director of Capital Projects
Josh Fleming, Senior Director of Facilities Maintenance
Bruce Hjort, Assistant Director of Energy Resources
Chris Kwolek, Building Controls Manager
Brian Pasquale, Senior Director of Engineering and Infrastructure

UMass Memorial Health

Bridgette Daley, Capital Planning, UMass Memorial Health
Kathleen Hylka, Vice President of Facilities and Support Services, UMass Memorial Health
Scott Reynolds, Director, Project Management, Office of Capital Planning and Management, UMass Memorial Health

Consultants

Charlotte Dean, District Energy Consultant, Arup
Jennifer Haugh, Vice President of Planning and Customer Engagement, GreenerU, Inc.
Eric Kupcinskas, Energy Project Manager, Arup
Chris Lewis, Vice President of Engineering, GreenerU, Inc.
Michael Lorimer, Associate Principal, Arup
Michael Mark, Vice President of Engineering, Waldron Engineering & Construction
John McCarthy, Senior Energy Consultant, Arup

UMass Chan's decarbonization planning process was supported by the consulting firms **Waldron, Arup,** and **GreenerU**.

You can get involved.

Any member of the UMass Chan or clinical system community is welcome to participate in UMass Chan's multiple campus sustainability and decarbonization initiatives. We need volunteers to share ideas, implement initiatives, and raise awareness on campus to advance the strategies set forth in our Sustainability and Climate Action Plan 2021–2026.

Contact

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Sustainability@umassmed.edu

Visit

umassmed.edu/sustainability