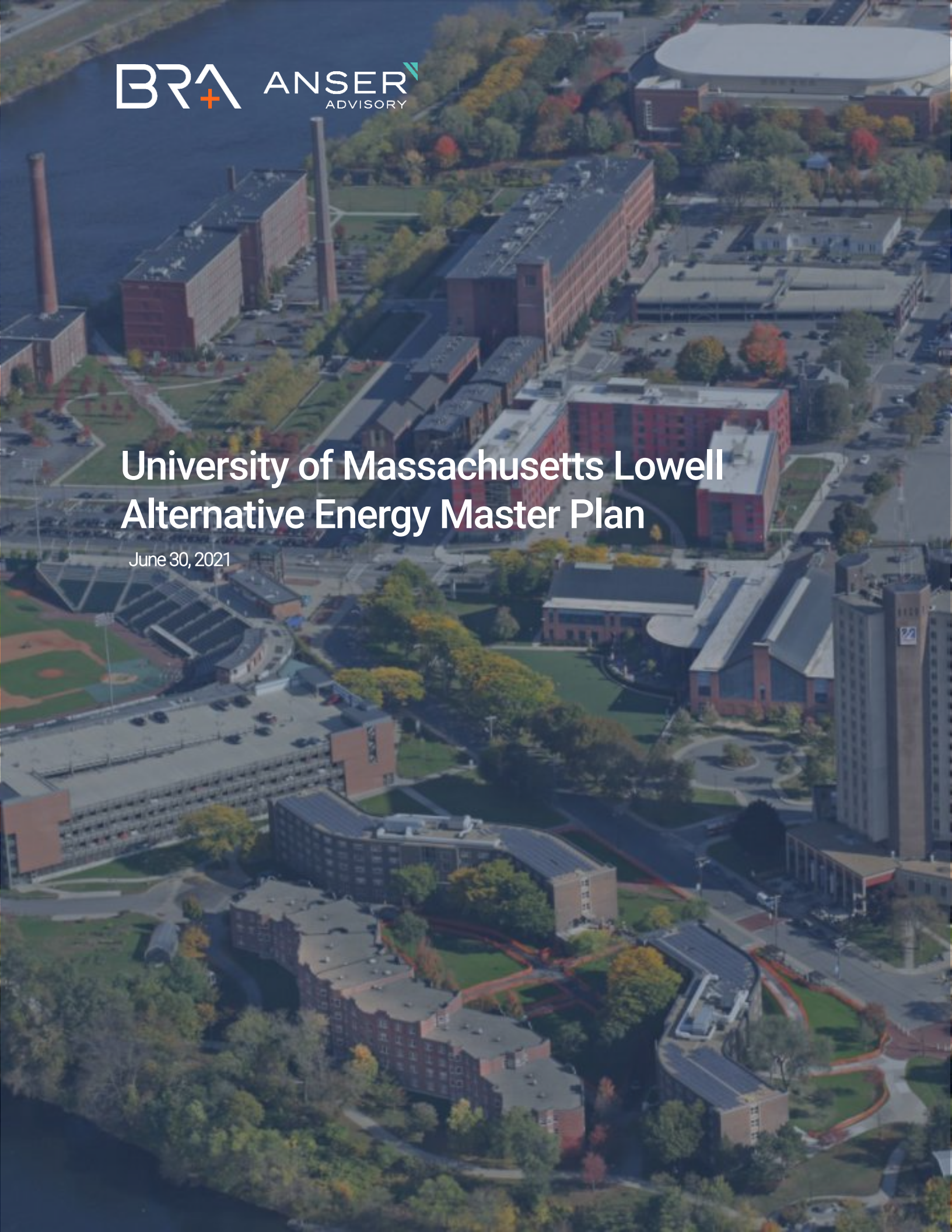




University of Massachusetts Lowell Alternative Energy Master Plan

June 30, 2021



An aerial photograph of a university campus, overlaid with a semi-transparent blue filter. The image shows a variety of architectural styles, including large brick buildings, modern glass-fronted structures, and a prominent stadium with a curved roof. Green spaces with trees are interspersed among the buildings. The overall scene is a dense, organized campus environment.

1 Executive Summary

Executive Summary

The University of Massachusetts at Lowell (UML) has set an ambitious goal to achieve carbon neutrality by 2050. To progress toward this goal, UML collaborated with BR+A Consulting Engineers and Anser Advisory, building on previous success, to develop this Alternative Energy Master Plan (AEMP). The AEMP effort grew out of a multi-year strategic planning process and in support of campus sustainability objectives, legislative mandates, and university commitments. The AEMP will assist UML in achieving interim carbon reduction goals with the ultimate goal of carbon neutrality by 2050 while aligning multiple stakeholder groups across the campus. This report was developed through comprehensive engagement with many stakeholders, including the Office for Sustainability; Facilities Operations and Services; Planning, Design, and Construction; Business Development (E2i); Research and Innovation; DOER; DCAMM; National Grid; and representatives from UML Academics.

Plan Goals

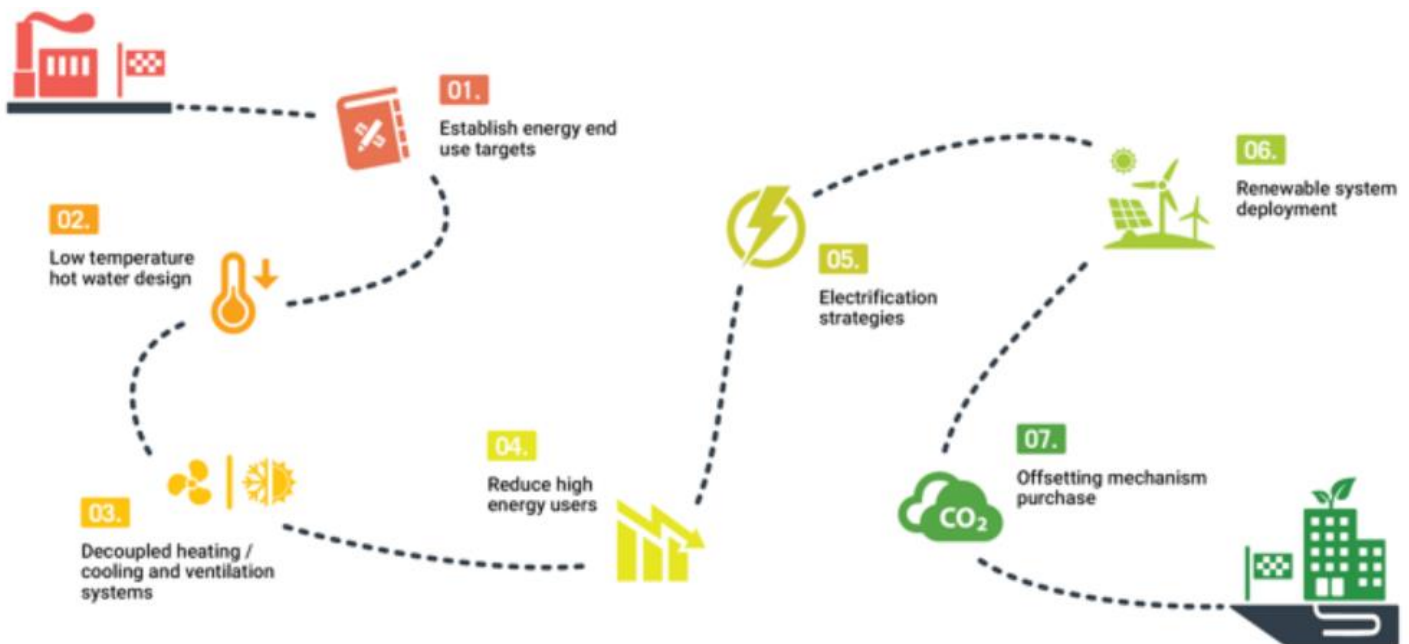
The University of Massachusetts Lowell (UML) has six primary goals in developing a comprehensive campus Alternative Energy Master Plan:

1. Evaluate UML's existing energy and metering, data management systems, and data governance practices to establish accurate usage and demand baselines, and to analyze onsite electricity and steam production, building-level performance, and campus-level energy performance on an ongoing basis;
2. Forecast the primary campus' annual energy demands between 2020 and 2050;
3. Identify, scope and estimate specific energy sources and/or energy savings opportunities that can meet the campus' growth over the next 30 years in a resilient, cost effective, and sustainable manner;
4. Identify and design energy sources and energy savings opportunities that can enable UML to meet the sustainability targets mandated under Executive Order 484 and the campus' carbon neutrality goals under the American College & University President's Climate Commitment in a reliable, cost effective manner;
5. Identify physical infrastructure, operating systems (mechanical, administrative, etc.), advantages and constraints for each identified location, and costs in order for UML to implement or upgrade recommended energy strategies to meet the campus' resiliency, utility cost, and sustainability objectives; and
6. Propose mechanisms for stakeholder engagement (students, faculty, staff, and broader community) throughout the planning process that offers opportunities for students and faculty to engage in planning, hands-on projects, and activities associated with the renewable energy goals.

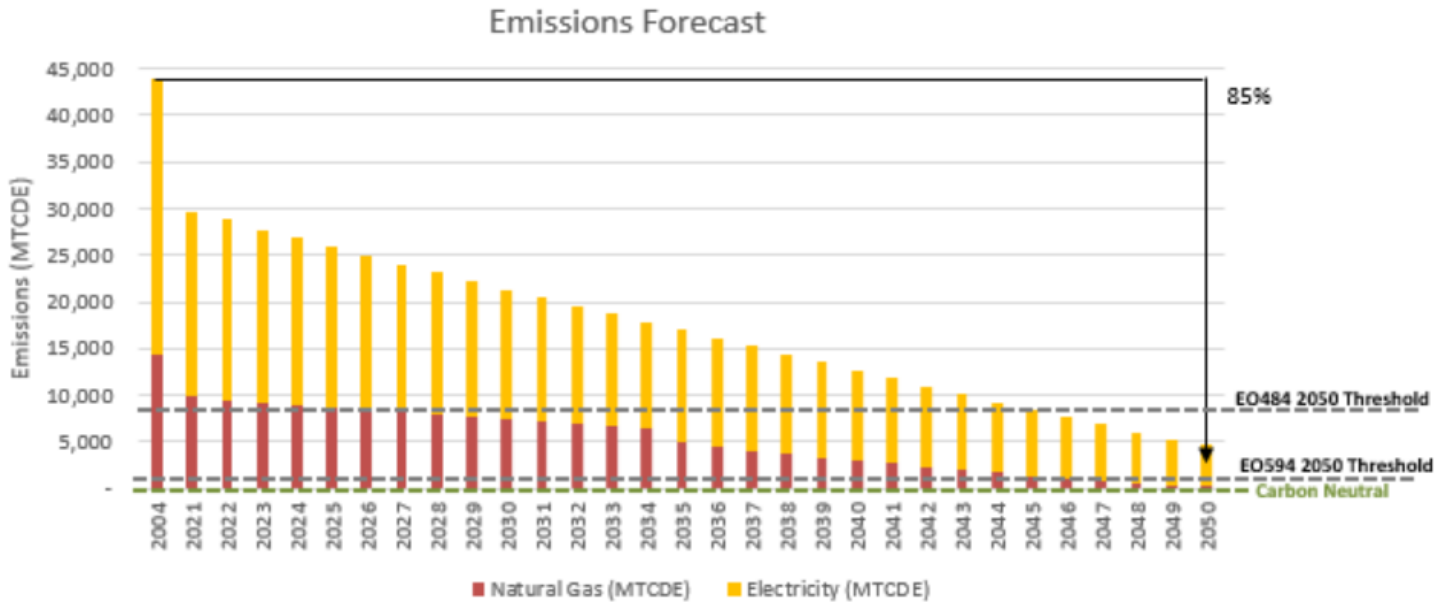
Roadmap to Carbon Neutral

This proven roadmap to carbon neutral builds on UML's successful Alternative Energy Project (AEP) load reduction, then applies electrification technologies to shift off of fossil fuels, and then offsets the remaining energy consumption with renewables:

1. **Energy efficiency.** The roadmap starts with developing a set of energy targets. Energy conservation measures (ECMs) are then applied to meet these targets prioritizing those buildings with the highest scores. Investment in energy efficiency reduces loads and thereby reducing the size and cost of plant and electrification infrastructure.
2. **Electrification.** After sufficient load reduction is achieved, then proven alternative energy measures (AEMs) are applied to further reduce energy consumption and reliance on fossil fuels for heating. The North Plant will be transitioned from a steam-based heating system to a low-temperature hot water heating system. The South and East campus buildings will rely on standalone, electrified plants.
3. **Renewables.** After all the energy is squeezed out of the campus, a carbon offset purchase would be required to meet carbon neutrality if the Massachusetts electricity grid is powered by anything less than 100% renewable energy. After review with UML, onsite solar PV can be deployed to reduce operating costs, but is not a critical strategy to reducing emissions given current regulation on renewable energy credit (REC) ownership and the critical role that the sale of RECs play in the economic feasibility of these types of projects.



The Selected Scenario results in significant reductions in energy and emissions. This creates a pathway towards carbon neutrality by 2050 as well as achievement of Executive Order 594 and Executive Order 484 requirements. The Selected Scenario is estimated to reduce building emissions 85% compared to emissions in 2004. About half of this reduction is the result of grid emission reductions.



Implementation Timeline

The timing of energy efficiency and alternative energy projects are prioritized based on building score and expected central plant infrastructure useful life. Energy efficiency projects for buildings on the North Campus are prioritized in order to reduce loads ahead of new central plant upgrades. The South Campus building energy efficiency and alternative energy projects would be prioritized next ahead of retiring the South Plant central plant assets while maximizing their useful life. Buildings on the East Campus would also consist of standalone heat pump heating/cooling plants.

