Syracuse University

Climate Action Plan

2024-2032

Sustainability Management
161 Farm Acre Road
Syracuse NY 13244

Summary

Syracuse University released its first Climate Action Plan (CAP) in 2009 and an updated plan was developed in 2022. This 2024 update provides a strategy to achieve the 2032 carbon neutrality goal.

The strategy to attain the 2032 goal is divided into two efforts, Phase I and Phase II. Phase I achieves the first 50% of gross campus carbon reductions and it is based on specific actions. Phase II mitigates the remaining 50% emissions, but it offers multiple strategies to achieve these reductions.

Phase I is in progress and it includes reduction of gross campus emissions by implementing energy efficiency projects and transitioning the campus fleet to zero emission vehicles (ZEVs). Indirect emissions will be mitigated by purchasing policy updates.

Phase II consists of multiple strategies to mitigate the remaining 50% of emissions. The principles governing Phase II will prioritize solutions that are locally impactful. The solution may include a blend of strategies including sequestration in forest properties, sequestration in the built environment, or onsite renewables.

External forces such as federal, state, and local policies and goals will play a major role in reducing campus emissions. New York state passed the Climate Leadership and Community Protection Act (CLCPA) in 2019 detailing clear goals and steps to create a cleaner and carbon neutral environment.[1] CLCPA requirements will decarbonize the electric grid by 2040 and will transform the transportation sector with requirements for ZEVs in 2035. National Grid has also committed to transition to renewable natural gas and hydrogen, creating a 100% fossil-free gas network.[2] These actions will significantly reduce University emissions from purchased utilities.

The 2023 gross emissions are approximately 61,000 MTCO2e. The Phase I strategies aim to decrease gross emissions to under 29,000 MTCO2e. A locally centered and balanced approach for Phase II will address the remaining emissions.

Definitions

Definitions of terms used in the plan are listed below. These definitions conform with industry standards.

- Greenhouse gas (GHG): A gas that traps heat in the atmosphere. All GHG emissions are converted to and measured as metric tons of carbon dioxide equivalent (MTCO2e).
- Carbon neutral: A condition where there are no net releases of GHG to the atmosphere, i.e. carbon emissions are offset by carbon sinks.
- Carbon offset: a tradeable token that represents an action that compensates for the emission of carbon dioxide into the atmosphere.
- Carbon sink: A process or asset that absorbs carbon from the atmosphere.
- Energy Use Intensity (EUI): A building's energy use in BTU/year divided by the building's floor area in square feet.
- MTCO2e: A unit of measure that represents the global warming potential of one metric ton of carbon dioxide. It's used as a way to standardize the impact of different greenhouse gas emissions into a single metric.
- NYS Climate Leadership and Community Protection Act (CLCPA): A New York state climate act requiring the state to reduce economy-wide greenhouse gas emissions 40 percent by 2030 and no less than 85 percent by 2050 from 1990 levels.
- SIMAP: Sustainability Indicator Management and Analysis Platform is a carbon and nitrogen-accounting platform that can track, analyze, and improve campuswide sustainability, hosted by the University of New Hampshire.

Greenhouse Gas Emissions Summary

Background

Sustainability Management calculates the greenhouse gas inventory yearly based on data gathered through building meters and University databases. Emissions are grouped into scope 1, scope 2, and scope 3 emissions to match the Greenhouse Gas Reporting Protocol[3].

- Scope 1: Emissions directly from campus through operations owned and controlled by the University. This consists of natural gas use in buildings and gasoline and diesel fuel used in University owned vehicles.
- Scope 2: Includes indirect emissions from utilities. This includes purchased electricity, steam, and chilled water.
- Scope 3: Includes indirect emissions. Scope 3 emissions are emissions generated by others in support of university operations. Example of scope 3 emissions include student/employee commuting, air travel, the purchasing of goods, and investments. The sources for scope 3 emissions that have been included in the GHG inventory are directly measurable or reasonably estimated with university databases. These emissions include reimbursed air travel, reimbursed auto travel and solid waste.
- Mitigation: Mitigation includes carbon sequestration and carbon offsets. Mitigation currently accounted for in the inventory includes carbon sequestration on the near campus forest properties.

The greenhouse gas inventory is updated yearly and published on the SIMAP (Sustainability Indicator Management and Analysis Platform) website. This inventory report details total emissions and the scopes/sources.

Emissions Factors

Emission factors for each emission source are updated each fiscal year based on the EPA's factors. Table 1 below shows the FY2023 emissions factors. The emissions factors are multiplied by the values of source to determine emissions. Emission factors for steam and chilled water is calculated each year based on the natural gas and electricity consumed to deliver the steam and chilled water to the building meters.

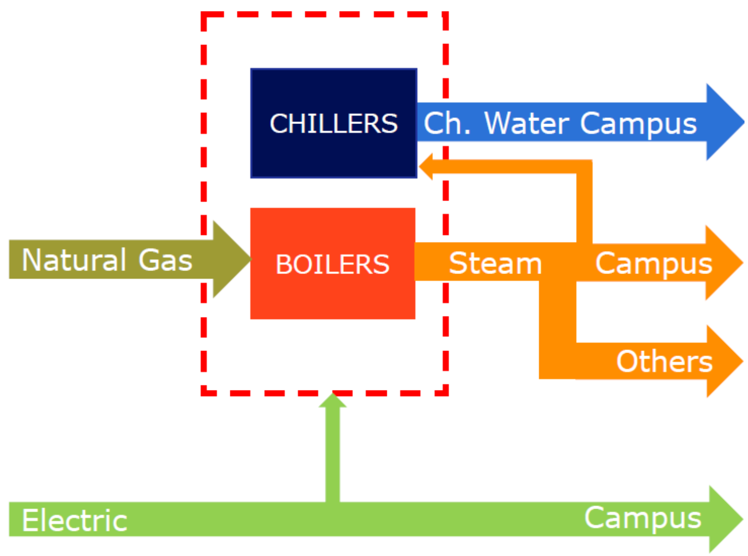
Source	Emissions Factor
Gasoline	0.00881334 MTCO2e/gallon
Diesel	0.01024409 MTCO2e/gallon
Natural gas	0.005320742 MTCO2e/therm
Electric	0.000106165 MTCO2e/kilowatt hour
Chilled water	0.0009 MTCO2e/ton-hour
Steam	0.0877 MTCO2e/kilo-pound
Solid waste	0.43 MTCO2e/stone weight
Directly financed air travel (faculty/staff)	0.000130217 MTCO2e/mile
Directly financed auto travel	0.000315286 MTCO2e/mile

Table 1: Emissions factors

Steam and Chilled Water Plant

The Steam and Chilled Water Plant is the primary source of heating and cooling for North Campus. Steam is produced at the plant by the combustion of natural gas. Chilled water is produced at the plant by using steam to drive a turbine chiller. An extensive network of underground steam and chilled water distribution piping provides steam and chilled water to North Campus buildings. Steam generated from the plant also serves SUNY ESF, Crouse Hospital, and the VA Hospital.

The steam and chilled water emissions are calculated each fiscal year and are based upon the emissions related to the fuel and electric input to the plant compared to the metered steam and chilled water use at the buildings. This accounts for plant losses and system distribution losses. The diagram in Figure 1 below shows inputs and outputs from the existing steam and chilled water plant and the equations to calculate the emission rates.



$$\frac{MTCO2e\ (Chw)}{ton-hr} = \frac{Electricity\ Consumed\ kWh \times \frac{MTCO2e}{kWh} + Steam\ Consumed \times \frac{MTCO2e}{klb}}{Total\ Metered\ Chilled\ Water\ ton-hr}$$

$$\frac{MTCO2e\ (steam)}{klb} = \frac{Electricity\ Consumed\ kWh \times \frac{MTCO2e}{kWh} + Natural\ Gas\ Consumed\ Therm \times \frac{MTCO2e}{Therm}}{Total\ Metered\ Steam\ klb}$$

Figure 1: Steam station inputs and outputs and emissions equations.

2023 Emissions

The emissions for 2023 have been calculated and are shown in Table 2 below.

Category	MTCO2e
Scope 1	8,977
Scope 2 (Gross)	48,695
Scope 3	3,195
Mitigation (Sequestration)	-80
2023 Net Emissions	60,787

Table 2: Emissions categories measured in Metric Tons of Carbon Dioxide equivalent.

The breakdown of emissions is shown in the two pie charts below. The pie chart on the left shows emissions broken down into scopes as described in the GHG protocol. The second chart shows emissions broken down into indirect emissions, transportation emissions, and emissions related to electricity, steam, chilled water, and natural gas supplied to buildings. More than 90% of University emissions are related to buildings.

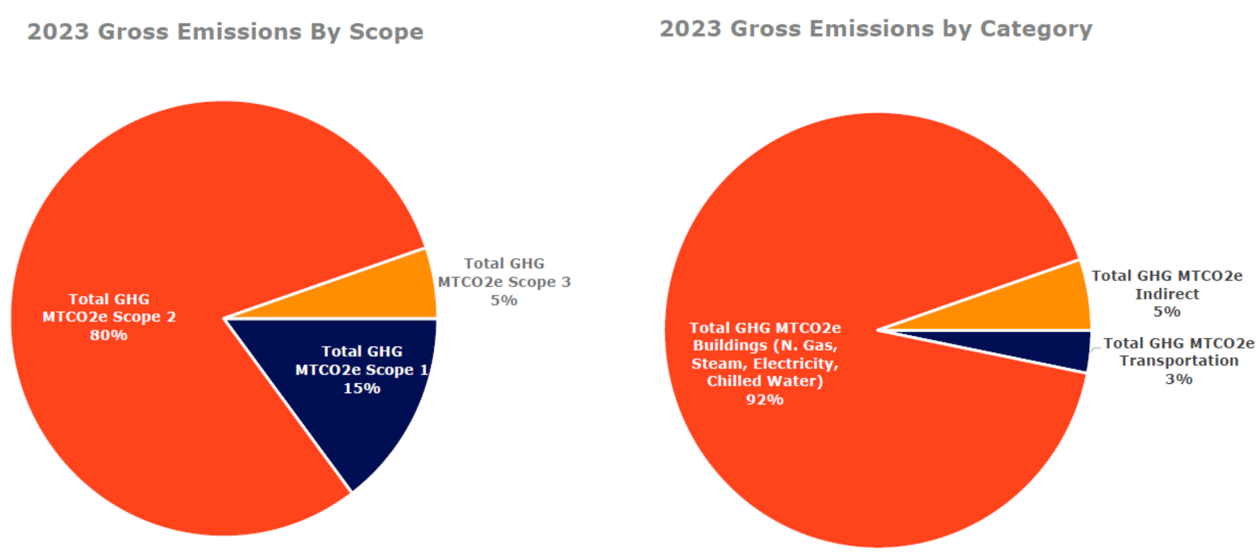


Figure 2: 2023 gross emissions broken down by scope and category.

Figure 3 below provides a further breakdown of gross emissions related to buildings and emissions relative to source. Purchased steam is the University's largest single source of emissions.

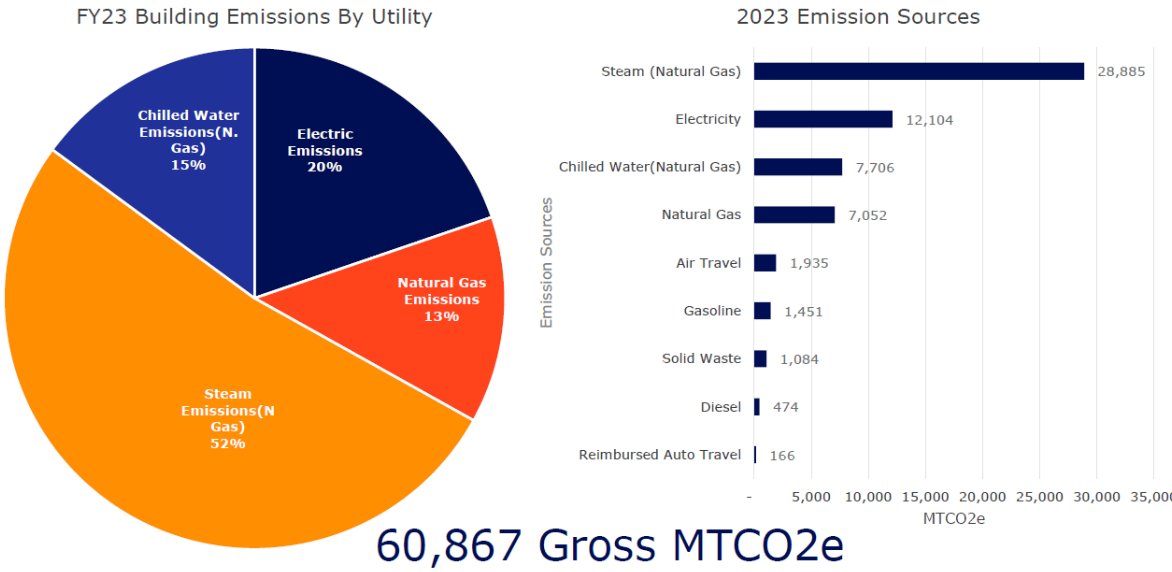


Figure 3: 2023 building emissions by utility and source of emissions.

2032 Net Zero – Phase I

The strategies to achieve net zero in 2032 are broken into two main efforts. Phase I includes energy efficiency projects, fuel transition, steam station modernization, and scope 3 policy updates. Phase I efforts focus on the most impactful emissions reduction and has economic benefits through reduced utility consumption.

Scope 1 Strategies

Syracuse University's scope 1 emissions come from fuels burned on site. This includes gasoline, diesel, and natural gas. Gasoline and diesel are primarily used for mobile transportation and natural gas is primarily used for building heating.

DIESEL AND GASOLINE:

All sales or leases of new light-duty passenger vehicles in New York will be zero emissions vehicles (ZEVs) by 2035, and all sales or leases of new medium and heavy-duty vehicles must be ZEVs by 2045 per the requirements of the Climate Leadership and Community Protection Act (CLCPA). We expect regulatory requirements, market pressure, and incremental replacements will transition most of the University fleet (90%) to ZEVs by 2032. Sustainability Management and Campus Planning, Design, and Construction will support fleet transition by ensuring campus utilities (specifically electric utilities) can support it.

Syracuse University currently offers six electric vehicle charging stations (12 ports) to drivers across campus. The average peak daily occupancy for the 2023 fall semester was 33% (4 ports). Sustainability Management regularly monitors the EV dashboard to ensure equipment is working properly and to analyze usage. The EV charging network will incrementally be increased to provide a convenience to campus constituents.

NATURAL GAS:

Natural gas is used for cooking, clothes dryers, emergency generators, science laboratories and building heating systems not connected to the central steam system. Building heating systems account for most of the gas use. Reducing natural gas use is a key component of the 2032 strategies. The goal is to minimize the amount of natural gas used in buildings by increasing energy recovery and improving gas use efficiency. Projects are in progress to advance effort. Specific projects to reduce natural gas use are as follows:

Completed Projects:

- 426 Ostrom Avenue and Haft Hall Boilers - High efficiency boilers replaced existing boilers at 426 Ostrom Avenue and Haft Hall.

Projects in Progress:

- Lally Athletics Complex: A new central heating plant is under construction that will include heat recovery chillers and high efficiency boilers. The plant will replace gas fired rooftop heating units.
- 621 Skytop: A heat pump project is in the early design stages that will use mostly recovered heat from the adjoining data center to provide heat to the building.

Projects in Development:

- Tennity Ice Arena Dehumidification Project – Evaluate alternative options for the gas fired dehumidifier.
- Science Laboratories – In recent renovation projects, Campus Planning, Design, and Construction has been removing natural gas from science laboratories as researchers have been shifting to electric laboratory equipment.

Scope 2 Strategies

Most of the University's emissions are scope 2. Emissions related to steam is the largest source of scope 2 emissions. Steam is used to heat buildings, heat building hot water, and it is used for sterilizer systems in laboratories. Steam is also used to drive turbines that generate chilled water to serve building cooling systems.

Steam and Chilled Water Plant Modernization

A modernization project at the steam and chilled water plant is underway. Major components of the project include the following efficiency upgrades:

- Electric Chillers – Electric chillers will reduce steam use and related steam emissions.
- Gas Turbine – A gas turbine is being added that will generate both electricity and steam.

Combined, these upgrades will lower the overall emission rate of the plant resulting in an annual emissions reduction of approximately 4,000 MTCO2e, or 8% of the University's scope 2 emissions.

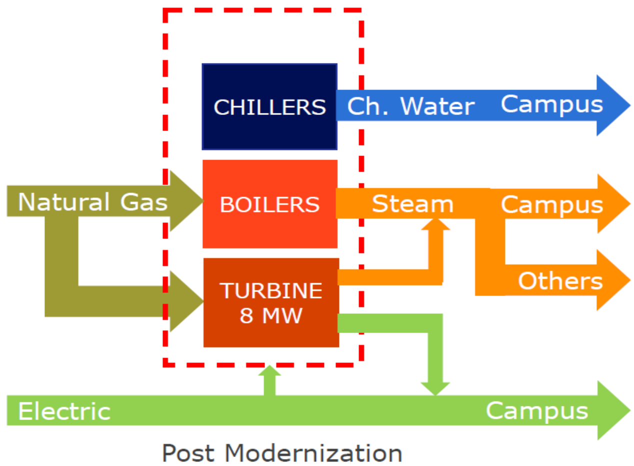


Figure 4: The inputs and outputs to the steam station and chilled water plant post modernization.

Category	2023 Emissions Factor	Post Modernization Emissions Factor	Emissions Factor Reduction
Electric	0.000106165 MTCO2e/kwh	0.000158664 MTCO2e/kwh	-49% (Increase)
Chilled water	0.0009 MTCO2e/ton-hour	0.000111065 MTCO2e/ton-hour	88%
Steam	0.0877 MTCO2e/klb	0.077771834 MTCO2e/klb	11%

Table 3: Emission factors before and after steam station and chilled water plant modernization.

Energy Conservation Projects

Energy conservation projects are a key element to reducing scope 2 emissions. A process for continuous energy benchmarking of campus buildings has been developed. The building benchmarking provides information on the highest energy users, the buildings with the highest Energy Use Intensity (EUI), and the buildings that are responsible for the highest emissions. Building EUI compares national databases provided by Energy Star Portfolio manager and the Energy Information Administration's Commercial Building Energy Consumption Survey.

This benchmarking helps identify the projects that provide the greatest reduction in emissions. Figure 5 below shows a treemap chart of emissions related to buildings. The data to produce this chart helps identify energy saving project opportunities.

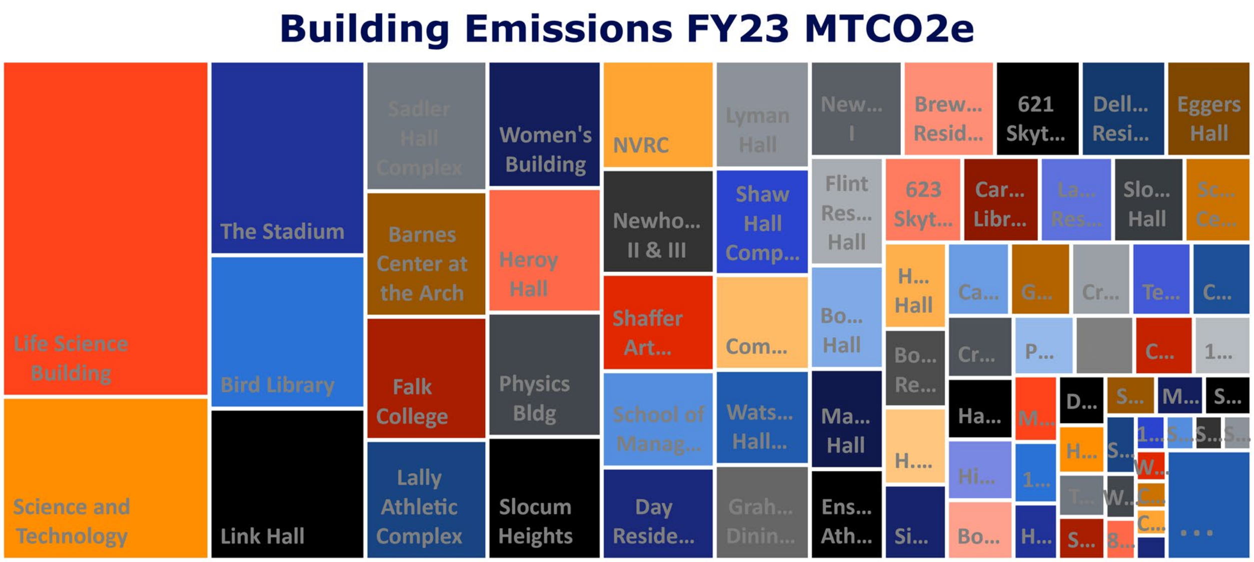


Figure 5: Building Emissions 2023

Energy conservation projects are focused on these energy-intensive facilities to ensure we are reducing scope 2 emissions. The goal is to reduce building energy use 50% below benchmark. Combined with the steam station modernization, this will reduce emissions by 27,000 MTCO2e per year and reduce building related emissions by 48% compared to current levels.

The focus for energy efficiency projects includes the science buildings, residence halls with dining facilities, and facilities with extended operating hours. Additionally, the campus chilled water loop will be used to share heating among the main campus buildings by expanding the use of heat recovery building chillers in select facilities. Projects are in various stages to accomplish these energy reductions.

Energy reduction to 50% below benchmark levels is an ambitious goal, however, it will provide both emission reductions and utility cost savings. Recent project data from the renovations at Center for Science and Technology and Schine Student Center demonstrate that energy efficiency provides the greatest emission savings at the lowest cost when compared to onsite renewables. This is summarized in the table below:

Project	Implementation Cost	Emission Reduction/Year (MTCO2e)	Utility Cost Savings/Year
Schine PV	$600,000	5.2	$3,432
CST Energy Recovery/Chiller	$720,000	500	$141,000

Table 4: Cost and Savings Comparisons

Energy reduction projects often coincide with capital renewal projects, resulting in only a minor additional cost for efficiency improvements. This strategic approach is integrated into Campus Planning, Design, and Construction’s capital projects, providing a cost-effective way to reduce carbon emissions.

FY23 Completed Projects & Savings

- CST Energy Recovery: Added an energy recovery loop to the laboratory exhaust. Reconfigured the chillers to operate in heat recovery mode. The upgrades completed in 2021 and 2022 have resulted in a 25% reduction in steam use in 2023 and a 500 MTCO2e annual emissions reduction.

Figure 6: Interior of mechanical room in the Center of Science and Technology.

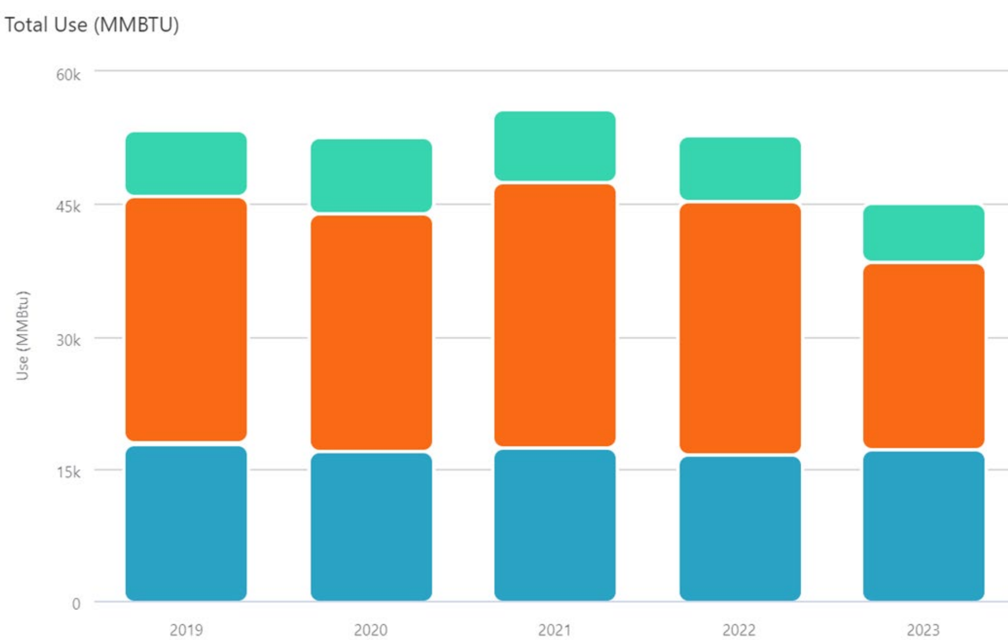


Figure 7: Total energy usage in MMBTUs for the Center for Science and Technology.

- Lally Arena Lighting: Full lighting replacement in the arena. The installation of LED fixtures at the Lally Arena reduced emissions by 100 MTCO2e a year.

Figure 8: New LED fixtures installed in the Lally Arena.

- Life Science Energy Upgrades Phase I: Upgraded control valve and reconfigured chiller piping to perform subsequent heat recovery projects.
- Site Lighting: Exterior LED fixtures were installed on South Campus, parking lots on North Campus, across the Quad and front lawn of North Campus, and near Flanagan gym. New LED fixtures across campus have reduced emissions by 87 MTCO2e annually.

Projects in Progress:

- Life Sciences Energy Upgrades Phase II: Install five heat pump systems into the existing runaround energy recovery loop to reduce steam consumption.
- Life Science Energy Upgrades Phase III: Modify the heating loop and modify the cooling loop to heat recovery chiller to reduce steam and chilled water consumption.
- Site Lighting: Complete site lighting fixture replacements.

Future Projects:

- Heat pump energy recovery in CST, Physics and Link Hall.
- Carriage House Heat Pump – Ground source heat pump project.
- Domestic Hot Water Conversions – Converting steam water heaters to electric or electric heat pump water heaters.

Energy Optimization

Energy use is continuously monitored, and formal meetings are held quarterly to review energy use trends and utility data. Sustainability Management regularly monitors building controls to pinpoint problems and identify and correct excess heating or cooling issues. Building schedules are updated each year to confirm that the building heating/cooling/lighting schedules align with space use. These no cost/low-cost updates will continue and will contribute to the decarbonization efforts.

Scope 3 Strategies

Solid waste, reimbursed faculty and staff air travel, and reimbursed vehicle mileage are included in the University's scope 3 emissions. These emissions are indirect emissions and mitigation of these emissions will be addressed by travel policy updates and vendor/contractor requirements at the point of purchase. Examples of policy updates would include the requirement to purchase a verified carbon offset when air travel is purchased.

Indirect emissions from student and employee commuting with personal vehicles will decline as the ZEV legislation comes into effect. Sustainability Management will continue to address scope 3 emissions by collaborating with University departments on policy guidance.

2032 Net Zero – Phase II

The Phase II strategies include mitigation of the remaining emissions. The exact strategies in Phase II are not defined, as the path to net zero will likely include a blend of each of these strategies. The guiding principle for Phase II is to maximize the local investment and achieve carbon neutrality in an economically responsible manner.

Potential Strategies

Forest Properties

In 2023, Sustainability Management retained a local forester to complete an inventory of the forest properties on campus. The properties include four stands (nearly 100 acres) on North and South Campus. Approximately 80 metric tons of carbon is sequestered annually in new growth. This sequestration rate was determined by the procedures described in US Forest Service GTR NRS-18 Measurement Guidelines for the Sequestration of Forest Carbon[4]. These stands will be evaluated in five years to confirm estimated growth rates. This local forest sequestration helps assign greater value to the local natural environment and encourages preservation of local natural areas.

Sequestration calculations can be expanded to include approximately 20,000 acres of University owned property in Adirondacks. It is expected that the forest properties can sequester an additional 17,000 MTCO2e per year based on a previous SUNY ESF study[5]. This is a feasible option to implement in Phase II, but the exact sequestration rate used to achieve net zero will be balanced with other strategies.

Sequestration in the Built Environment

Carbon emissions can also be sequestered in building materials. This can be achieved by using both low impact carbon materials and materials that store carbon. This could include the use of alternative building materials such as mass timber and revised concrete mixes. Other emerging natural materials such as mycelium insulation may also play a role in sequestering carbon in buildings. We expect these materials to play a greater role in future construction, and these materials may allow us to use construction as a means of sequestering carbon.

External Influences

National Grid plans to eliminate fossil fuels from its existing gas network by delivering a blend of renewable natural gas and carbon free hydrogen by 2050. New

York State's electric grid will be 70% renewable by 2035 and carbon free by 2050. These actions will help the University significantly reduce its emissions related to purchased utilities. These external influences will affect the strategies chosen in Phase II efforts.

ONSITE RENEWABLE ENERGY GENERATION

The installation of onsite renewable technologies will be considered as we approach the 2032 carbon neutrality date. Energy efficiency in Phase I and the planned decarbonization of the grid and gas network will reduce the quantity and type of onsite renewables needed to affect emissions. Onsite renewables may have the ability to affect gross emissions more substantially after energy efficiency measures have been implemented.

CARBON OFFSETS

Another possible method to contribute to net zero goals is through the purchase of carbon offsets. Carbon offsets fund projects that actively lower or sequester carbon and reduce greenhouse gas emissions. Although carbon offsets are feasible, the purchase of them is not part of the University's plan to achieve carbon neutrality.

2032 Gross Campus Emissions

Sustainability Management has developed a technically feasible path to carbon neutrality 2032. The strategy prioritizes energy efficiency. This path is shown in Figure 9 below.

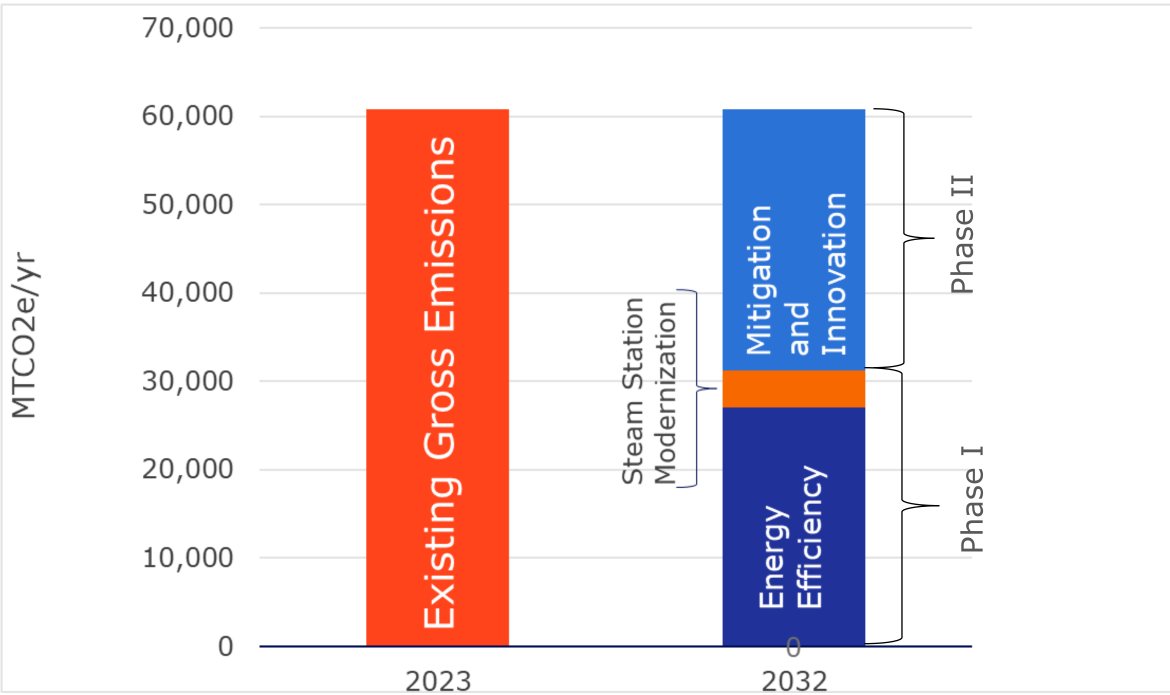


Figure 9: Comparison of gross emissions in 2023 and the strategies used to reach carbon neutrality by 2032.

Phase I and Phase II will each provide approximately 50% of the gross emission reduction. The exact strategies used in Phase II will be selected as the industry evolves, however there is a technically feasible path to reduce net emissions to approximately 12,000 MTCO2e through forest sequestration. The remaining 12,000 MTCO2e will be addressed through emerging opportunities, which may include sequestration in the built environment, on site renewables, innovation, and external influences from the requirements of CLCPA and the gas utility.

Sustainability Management recognizes the path to carbon neutral is involved and will evolve and change overtime. There will be room for adaptation and improvement as more information becomes available and technologies develop. Sustainability Management is committed to reducing Syracuse University's environmental impact in a responsible manner.

Sources:

[1] *Climate Act.* (n.d.) State University of New York. Retrieved March 6, 2024 from https://climate.ny.gov/

[2] National Grid. (2020, September). *Our Plan: National Grid Net Zero by 2050.* https://www.nationalgridus.com/media/pdfs/our-company/netzeroby2050plan.pdf

[3] Ranganathan, J., Corbier, L., Bhatia, P., Schmitz, S., Gage, P., Oren, K., Dawson, B., Spannagle, M., Boileau, P., Frederick, R., Vanderborght, B., Thomson, F., Koichi, K., Woo, C. M., Pankhida, N., Miner, R., Segalen, L., Koch, J., Bhattacharjee, S., … Cook., E. (2004). WBCSD/WRI, 2004. Greenhouse Gas Protocol: a Corporate Accounting and Reporting Standard. https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

[4] Pearson, T. R.H., Brown, S. L., Birdsey, R. A. (2007). Measurement guidelines for the sequestration of forest carbon. Gen. Tech. Rep. NRS-18. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. https://www.nrs.fs.usda.gov/pubs/gtr/gtr_nrs18.pdf

[5] ESF Sustainability Division. (2021). ESF Carbon Budget.