


Rochester Institute of Technology
2017 Climate Action Plan

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Contents

Executive Summary

Rochester Institute of Technology became a signatory of the American Colleges and University President's Climate Commitment in 2009, and committed to become carbon neutral. A Climate Action Plan was created in 2011 to outline initial steps towards reaching carbon neutrality by 2030. RIT has recently updated its commitment to include climate resilience. This 2017 Climate Action Plan update outlines a roadmap for the Rochester Institute of Technology to achieve carbon neutrality and climate resilience.

2009 was established as the baseline year for RIT's greenhouse gas inventory. That year, RIT emitted **77,614 metric tons** of carbon dioxide equivalent (MT CO2e). The inventory includes greenhouse gas emissions from on-campus stationary, fleet vehicles, refrigerants and chemicals, agricultural sources (fertilizer), purchased electricity, faculty/staff and student commuting, and directly financed outsourced travel. By 2016, RIT's emissions declined to **53,762 MT CO2e**.

Faculty, staff, students and community members were engaged in the 2016-2017 planning process to determine goals, strategies, and actions to reach carbon neutrality and climate resilience.

The following goals were identified for meeting the Climate Commitment:

1. Build adaptive capacity and reduce vulnerability to Climate Change
2. Reduce dependence on, and increase diversity of, external suppliers for critical resources
3. Reduce RIT's purchased energy use by 15% by 2020, 25% by 2025, and 40% by 2030
4. No net increase in carbon dioxide emissions from new buildings by 2020
5. Fossil Fuel Free by 2045
6. Improve reliability and accuracy of data for GHG calculations by 2018
7. Net increase in carbon sequestration on campus landscapes by 40% by 2030
8. Reduce emissions associated with commuting by 40% by 2020, 45% by 2025, and 60% by 2030

The 2017 Climate Action Plan creates a preliminary roadmap for achieving the Climate Commitment. Next steps will be to expand the greenhouse gas inventory to include more Scope 3 emissions, develop a protocol for offsetting carbon dioxide emissions, and create roadmaps for RIT's international campuses to meet the Climate Commitment.

Acknowledgements

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Introduction

The Rochester Institute of Technology (RIT) is a privately endowed, coeducational university with nine colleges that emphasize career education and experiential learning. RIT offers a wide range of undergraduate and graduate programs, including one of the only Ph.D. programs for sustainability in the country. RIT's main campus is located in Rochester, New York. The university also has a number of international locations in Eastern Europe, Dubai, and China.

In 2009, President Destler signed the American College and University President's Climate Commitment (ACUPCC). Through the work of RIT's first Climate Action Planning committee in 2010-2011, RIT committed to achieving carbon neutrality by 2030. The 2011 Climate Action Plan (CAP) outlined projects that were already underway, laid out short and mid-term reduction strategies, and identified items for further exploration.

RIT has implemented many of the strategies outlined in the initial CAP, including increasing student, staff, and faculty engagement. In 2013, RIT established an annual Climate Speaker Series, bringing climate scientists to campus to expand the RIT community's understanding of the breadth and depth of Climate related issues. A team taught Climate Change class was introduced in 2015 and efforts are now underway to establish a Climate Change Immersion. In 2016, RIT hosted a Student Climate Leadership Summit to motivate and equip student leaders from local universities and colleges with the tools to take action at their schools. Community leaders spoke to the students about sustainable development projects in the Rochester Community and held workshops to teach students the skills necessary to help lead the movement.

One of the goals established by the Paris Climate Accord was to hold…"the increase in the global average temperature to well below 2 °C," acknowledging that some temperature increase is inevitable (Nations, 2015). In fact, the world has already begun to see the effects of climate change (Shaftel, 2017). Therefore, in 2016, RIT updated its Climate Commitment to incorporate resilience and adaptation to climate change. The 2017 CAP focuses on four areas: Energy, Land Use and Transportation, Built Environment, and Resilience. This CAP is a roadmap for the RIT Main Campus to reach carbon neutrality and climate resilience. However, the university's Climate Commitment extends to its international campuses. In the coming years Climate Action Plans will be developed for each of its international campuses.

Understanding Climate Change

Human activities have generated large amounts of carbon dioxide and other greenhouse gases that have been released into the Earth's atmosphere. Greenhouse gases trap heat in the Earth's atmosphere, warming the Earth (Figure 1). This phenomenon is called the Greenhouse Effect. Without the Greenhouse Effect, life on Earth would not exist. However, human activities have upset the natural equilibrium by introducing additional carbon into the natural carbon cycle. Human activities such as combustion of fossil fuels, livestock production, deforestation, and waste generation produce greenhouse gas emissions. By adding these additional greenhouse gases, the Earth has started to warm at an abnormal rate, and as a result, the climate has begun to shift. Shifting climates are predicted to create more extreme conditions, resulting in a less stable environment (Field, et al., 2010; 2014 National Climate Assessment, 2014).

Changes in climactic conditions have already been observed worldwide. From 1880 to 2012, there has been an increase in the average global temperature by 0.85°C, or 1.53°F. By the end of the century, the Intergovernmental Panel on Climate Change (IPCC) predicts a 0.5-8.6°C, or 0.9-15.5°F, increase in global temperatures (Field, 2012).

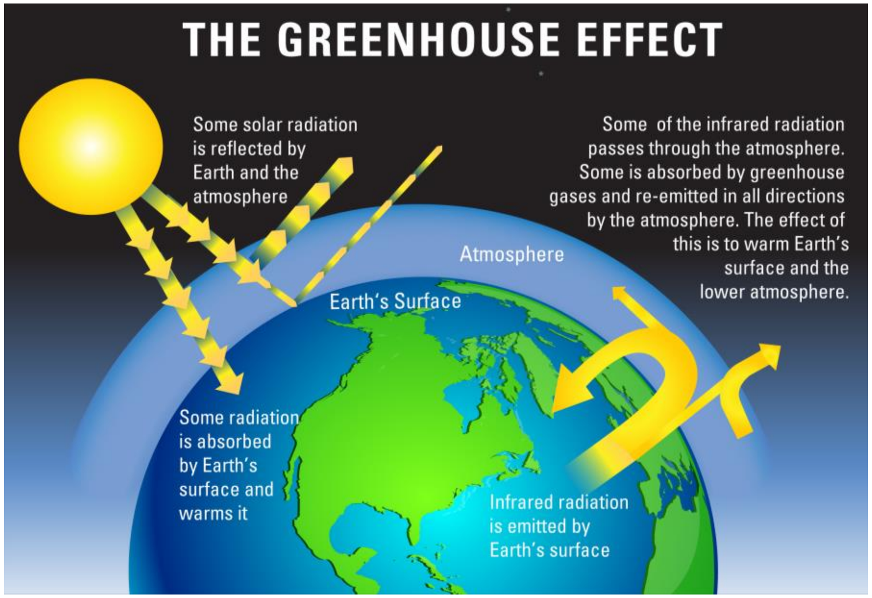


Figure 1: The Greenhouse Effect: The cause of Climate Change (Source: U.S. EPA 2012)

New York State's average temperature is projected to increase 5.3-10.1°F by 2080. Table 1 shows Rochester specific projected changes in temperature and precipitation (Rosenzweig, 2014). Since 1970, statewide average temperatures have already risen by nearly 2°F (New York State Department of Environmental Conservation). Rochester, New York, is expected to experience more extreme hot temperatures and heat waves, extreme cold temperatures and severe winter storms, increased precipitation and flooding, more frequent droughts, and more extreme events including wildfires and landslides (Brooks & Rion, 2011).

Region 1 (Rochester) – Temperature			
Baseline (1971-2000) 47.7 °F	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
2020s	+ 1.8 °F	+ 2.3 to 3.2 °F	+ 4.0 °F
2050s	+ 3.7 °F	+ 4.3 to 6.3 °F	+ 7.3 °F
2080s	+ 4.2 °F	+ 5.7 to 9.6 °F	+ 12.0 °F
2100	+ 4.6 °F	+ 6.3 to 11.7 °F	+ 13.8 °F
Region 1 (Rochester) – Precipitation			
Baseline (1971-2000) 34.0 inches	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
2020s	0 percent	+ 2 to + 7 percent	+ 8 percent
2050s	+ 2 percent	+ 4 to + 10 percent	+ 12 percent
2080s	+ 1 percent	+ 4 to + 13 percent	+ 17 percent
2100	- 3 percent	+ 4 to + 19 percent	+ 24 percent

Table 1: Projections of Mean Annual Changes in Air Temperature and Precipitation for Climate Region 1 in New York State

Greenhouse Gas Inventory

RIT conducts greenhouse gas (GHG) inventories every two years as part of its climate commitment through Second Nature. 2009, the year RIT became a signatory to the Climate Commitment, has been established as the baseline year. All goals that identify a percent reduction in this plan refer to a reduction over the 2009 baseline.

The GHG inventory is calculated using the University of New Hampshire's Campus Carbon Calculator, a tool designed specifically for use in higher education. The Calculator measures the GHG emissions defined in the Kyoto Protocol (CO_2, CH_4, N_2O, HFC, PFC, and SF_6) (University of New Hampshire Sustainability Institute).

The inventory is divided into Scopes 1, 2, and 3. A breakdown of RIT's emissions by scope and source can be found in Table 2.

Emissions	Source	Metric Tons of CO2 Equivalents
Scope 1	Natural Gas	19,576
	Mobile sources	425
	Chemicals	177
Scope 2	Electricity	13,383
Scope 3	Commuting	16,638
	Air travel	4,188
	Solid waste methane capture	(53)
	T & D losses (electricity)	1,351
Offsets	REC's	(1914)
Total		**53,762**

Table 2: RIT's 2016 GHG Emissions by source

Scope 1

Scope 1 emissions are direct emissions from owned or controlled sources. At RIT, these include On-Campus Stationary Combustion, Fleet Vehicles, and Refrigerants and Chemicals (fertilizers). Natural gas is combusted on campus to heat buildings, which is the primary source of RIT's Scope 1 emissions.

Scope 2

Scope 2 emissions are indirect emissions that result from the generation of purchased energy. Approximately 3% of RIT's electricity is generated through on-site solar electric production. The remaining 97%, is purchased. Purchased electricity is evaluated using the EPA's eGrid average grid emissions factors.

Scope 3

Scope 3 emissions cover all indirect emissions that result from the activities of an organization. RIT's Scope 3 emissions include Faculty/Staff Commuting, Student Commuting, Directly Financed Air and Vehicle Travel, Solid Waste, and Scope 2 T&D losses.

Much of Scope 3 data is currently based on commuter surveys and industry conversion calculations of cost to GHG emissions. Therefore, Scope 3 emissions values are less certain than Scopes 1 and 2. Goals and strategies that will improve data reliability for Scope 3 emissions have been included in this CAP.

Best practice for university Scope 3 reporting includes emissions associated with waste water, as well as paper and food purchases. These data points have not been included in RIT's inventories to date because of inconsistent data availability. This CAP identifies strategies to address the data availability issues in order to account for these sources in future GHG inventories.

The Cost of Inaction

There are multiple pathways to neutrality. The fastest, though least impactful and likely the most expensive, would be to pay to offset all of RIT's emissions annually. Based on Second Nature's guidance to signatories, this would mean purchasing offsets for

Scope 1 and 3 emissions and renewable energy credits for all Scope 2 emissions. This would be an annual expense as operations would not change and emissions would continue to be generated.

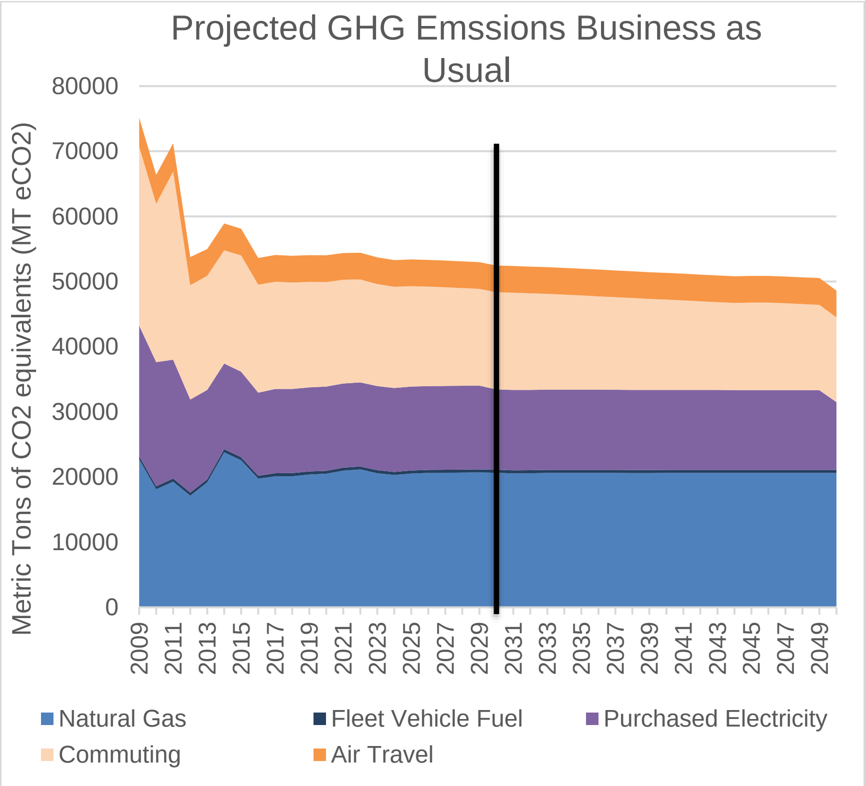


Figure 2: RIT's Projected GHG emissions in a business as usual scenario

Figure 2 illustrates RIT's projected emissions based on a business as usual scenario. In this case, emissions from electricity are expected to decline slightly as the grid in New York State becomes cleaner under its 2015 Energy Plan. Emissions from commuters are projected to decrease slightly as a result of increasing fuel efficiency of newer vehicles and expanded electric vehicle ownership.

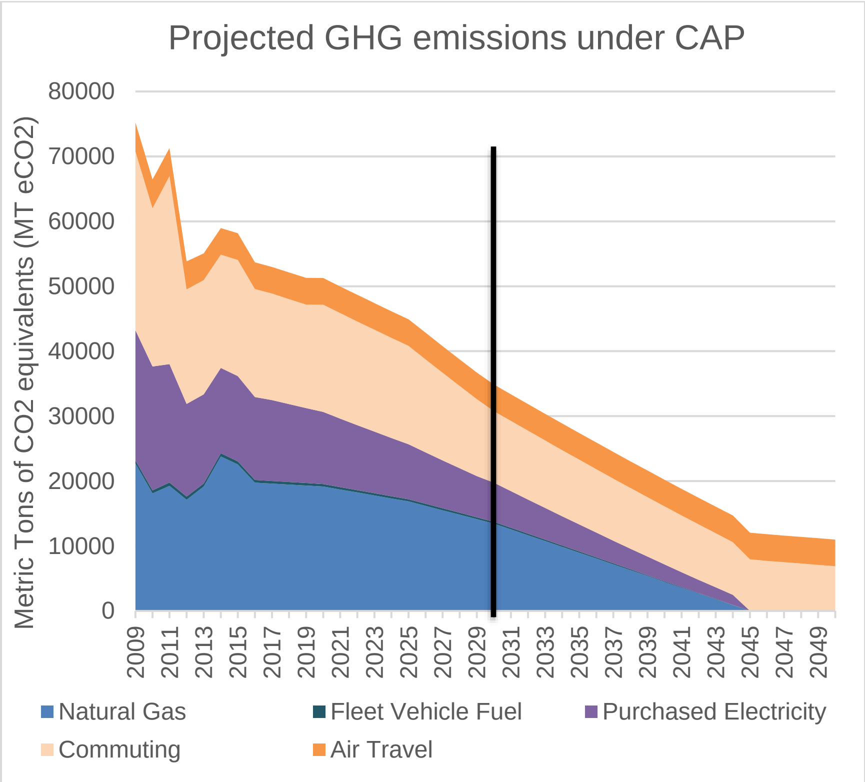


Figure 3: RIT's Projected GHG emissions under 2017 CAP

The graph in Figure 3 shows the reduction in emissions that are expected to result through the implementation of this plan. 2030 is the year RIT has committed to achieving carbon neutrality.

Operational emissions will be dramatically reduced by that year; however, they will not be zero for Scope 1 or 2 until 2045. Carbon offsets will be required to achieve neutrality during that time interval. The “Next Steps” section of this plan addresses the development of mission linked carbon offsets. In both senerios air travel emissions are held constant. Global engagement is an important part of RIT’s strategic plan. So while the airline industry has established emission reduction targets, air travel will likely increase as RIT advances its its global engagement goals. Therefore it is assumed these two facors canel each other out and RIT’s air travel related emission remain roughly the same over time.

Using utility forecasts for carbon pricing (Luckow, et al., 2016), as well as current offset and REC pricing, Table 3 illustrates the projected cost to purchase offsets for carbon neutrality annually through 2050 for both scenarios. Where forecast data was not available, a 3% inflation rate was assumed. While there is not currently a national cost on carbon. It is widely believed there will be one within the next 7-10 years as reflected in the utility carbon price forecast.

			Business as Usual Scenario			CAP Scenario		
Year	**Carbon offset Price/ton Scopes 1 & 3)**	**REC's/kwh (Scope 2)**	**Cost of Scope 1 & 3**	**Cost of Scope 2**	**Total Cost of Neutrality**	**Cost of Scope 1 & 3**	**Cost of Scope 2**	**Total Cost of Neutrality**
2020	$10.93	$0.0044	$361,620	$264,604	$626,225	$244,041	$253,134	$497,175
2025	$17.25	$0.0051	$565,913	$306,749	$872,662	$348,552	$258,928	$607,480
2030	**$21.00**	**$0.0059**	**$686,071**	**$355,606**	**$1,041,677**	**$342,946**	**$240,135**	**$583,080**
2035	$24.75	$0.0068	$802,587	$412,245	$1,214,832	$316,201	$185,588	$501,789
2040	$28.50	$0.0079	$915,352	$477,905	$1,393,257	$262,521	$107,574	$370,095
2045	$32.25	$0.0092	$1,028,861	$554,023	$1,582,884	$182,565	$0	$182,565
2050	$36.00	$0.0106	$1,140,947	$642,264	$1,783,211	$190,307	$0	$190,307

Table 3: Cost to purchase carbon neutrality over time

Process

The 2017 CAP was developed through the engagement of faculty, staff, students, and community members. An Advisory Committee was created to guide the development of the plan and approve the plan content. The committee identified the plan's overarching strategies, objectives, and scope.

Three Working Groups (Energy, Built Environment, and Land Use and Transportation) were then formed to assist with the development of the CAP using guidance provided by the Advisory Committee (Figure 4). The Working Groups were tasked with identifying tangible carbon reduction and sequestration strategies, prioritizing resilience and adaptation measures, and exploring related academic opportunities that will enable RIT to achieve its stated goal of carbon neutrality by 2030. The working groups met concurrently during three charrettes held in the fall of 2016.

The planning process was developed based on Swarm Planning Theory and managed by the RIT Sustainability office (Roggema, 2012). The first charrette focused on prioritizing vulnerabilities and determining adaptation strategies based on the Climate Vulnerability Assessment. More information about the development of the Climate Vulnerability Assessment can be found in the Resilience Section of this plan. During the second charrette working groups defined goals, strategies, and actions for their respective topics. The final charrette focused on opportunities for student engagement and financing the commitment. Additionally, posters were created for the third charrette to summarize the CAP content pulled from previous charrettes for the planning committee to review and provide commentary on.

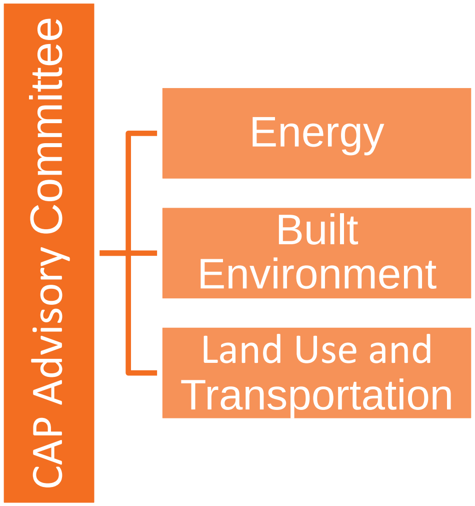


Figure 4: CAP Governance Structure

Guiding Principles

The four components of RIT's sustainability strategy are: Global Citizenship, Campus as a Living Laboratory, Innovative Academic Programs, and Community Engagement. These components have been integrated into RIT's 2015-2025 Strategic Plan as reflected in Dimension 5: Difference Maker v.5., the text of which can be found on the next page. The strategic plan objectives of this difference maker are used as the guiding principles of the 2017 Climate Action Plan. This ensures that the updated CAP will help to advance the University's strategic plan.

DIMENSION 5: ORGANIZATIONAL AGILITY DIFFERENCE MAKER V.5

In the service of ensuring a sustainable planet, RIT will restore, ameliorate, and work within the systems and resources necessary to meet the needs of the current generation in an equitable manner without jeopardizing future generations.

Objective V.5.1

- RIT will cultivate global citizens and leaders prepared to address the inter-connected ecological, economic, social, and ethical challenges of creating a sustainable future.

Objective V.5.2

- The RIT campuses will serve as living laboratories for and international models of campus sustainability, with infrastructure and operations designed to reflect our leadership in sustainability, adaptation, and resiliency.

Objective V.5.3

- RIT will develop innovative curricula, programs, and research that foster a commitment to sustainability.

Objective V.5.4

- RIT will partner, locally and internationally, with the communities in which it is engaged to advance sustainability and build resiliency

A carbon management hierarchy was developed to guide the planning process and prioritize strategies identified by the working groups. The highest priority is to avoid activities that create carbon emissions where ever possible. Second: reduce carbon emissions through improved efficiencies. Third: replace high-emitting sources with low or no emitting sources, such as renewable energy. Fourth: sequester carbon where possible. Fifth: Offset emissions that are unavoidable (Figure 5).

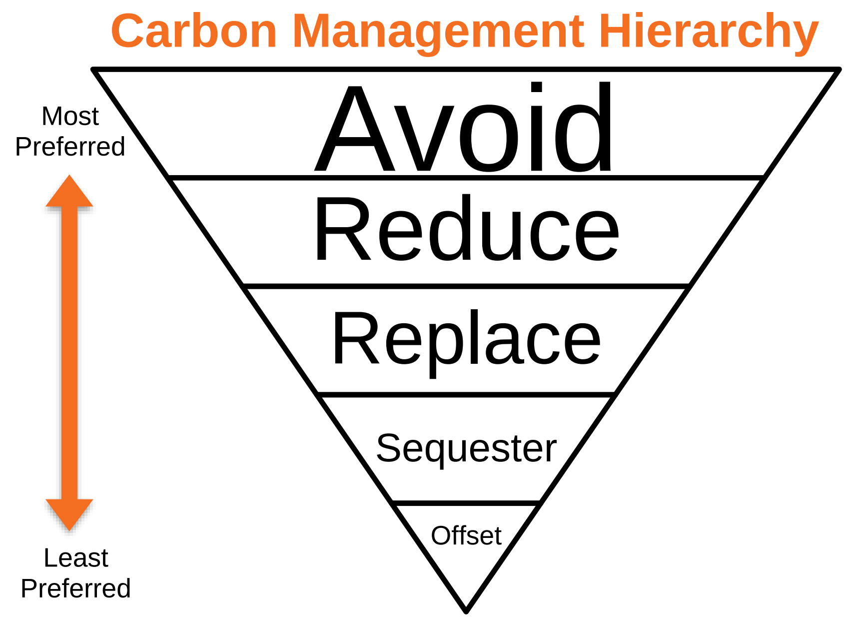


Figure 5: Carbon Management Hierarchy

The planning process was designed to be integrative, focusing on both mitigating impacts and adapting to climate change. Mitigation strategies focus on reducing greenhouse gas emissions, while adaptation strategies aid the University in preparing and responding to the impacts of climate change. Figure 6 illustrates this concept. During the planning process, those strategies that advanced both mitigation and adaptation were given a higher priority.

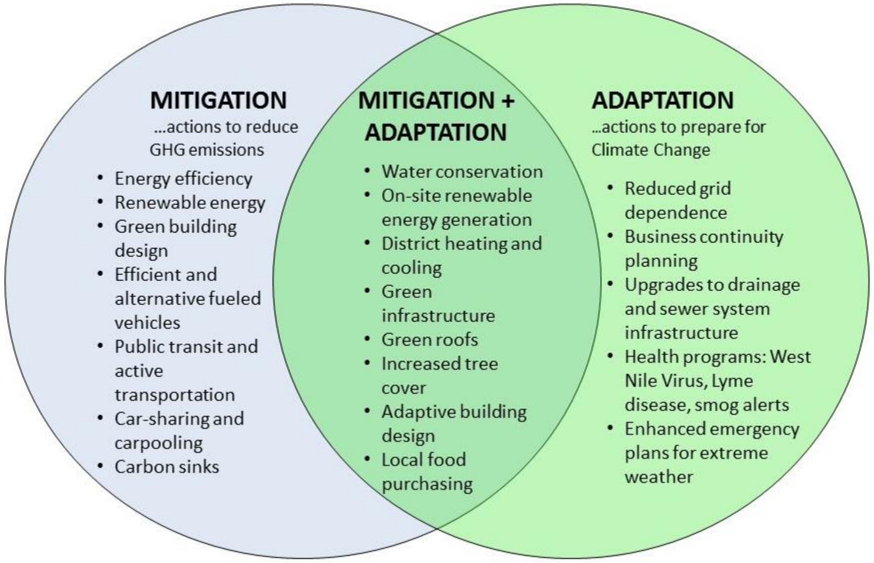


Figure 6: Overlap of Mitigation and Adaptation Strategies

Refining the Commitment

The original Climate Action Plan identified 2030 as RIT's target date for carbon neutrality and covered Scopes 1, 2, and 3. Scope 3, as described previously in the Greenhouse Gas Inventory section of this report, includes the emissions from faculty, staff, and student commuting. RIT recognizes the role it can play in advancing and improving alternative transportation options for its community. However, while better options can be provided, it is ultimately up to individuals to decide how they will get back and forth to campus. Therefore, the commitment has been further refined during the planning process of this CAP.

Refined Commitment: RIT will be carbon neutral for Scopes 1 and 2 emissions and will reduce Scope 3 emissions by at least 50% by 2030. In order to realize the Scope 3 reductions, offsets will likely be required.

This acknowledges the shared responsibility for emissions associated with commuting, as well RIT's accountability for its other Scope 3 emissions.

Working Group Charges

Energy

1. **Short Term and Long Range Energy Planning** – Taking into account current and future energy needs and projected campus growth, develop an energy plan/road map for carbon neutrality by 2030. This should include the development of strategies related to energy conservation and efficiency, on-site renewables, and green power purchasing. Strategies should aim to eliminate the University's use of fossil fuels, for which a target date will be set.
2. **Adaptation and Resilience** – Consider energy security issues as they relate to climate change and how future energy infrastructure projects can build adaptive capacity to some of these risks.

Land Use and Transportation

1. **Carbon Sequestration or Campus Offset Opportunities** – Identify carbon sequestration potential on campus or offset opportunities that will benefit the university. Standards, measurement, and verification must be part of any recommended strategy.
2. **Low Carbon Transportation and Maintenance Practices**– Identify ways to reduce the carbon intensity of transportation and maintenance associated with university operations. This includes University owned equipment and transportation that is contracted on the University's behalf.
3. **Adaptation and Resilience** – Identify land management and transportation policies and strategies that will enhance RIT's ability to adapt to the changing climate, with particular emphasis on storm water management, invasive species, heat island effect, and critical infrastructure.

Built Environment

1. **Standards for New Construction and Renovations** – Develop guidelines/standards to reflect a holistic and comprehensive approach to sustainability in the design and construction process. The standards should identify specific strategies that will enable RIT to reach its carbon neutrality goal while enabling any necessary growth associated with the strategic plan.
2. **Adaptation and Resilience** – Identify design strategies that will enhance RIT's ability to adapt to the changing climate, utilizing an updated 100 year flood map.

All Three Working Groups

1. **Emerging Technology and Research Opportunities** – Identify opportunities to integrate research into campus operations and leverage research funding opportunities for on-campus infrastructure that will support RIT's carbon neutrality efforts
2. **Education and Outreach Priorities** – Explore synergies between current academic programs and campus operations, as well as ways to engage the campus community in energy conservation efforts.
3. **Funding sources** – Recommend financing strategies for proposed projects and identify collaboration opportunities on future grant proposals.

Resilience

Resilience is defined as, "the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions" (United States Department of Homeland Security, 2016). As part of RIT's commitment to climate resilience, a Climate Vulnerability Assessment was performed and is described in this section of the plan. There are several components to consider when creating a vulnerability assessment, including threats to critical infrastructure, operational systems, and environmental challenges.

As part of this process, the team engaged the interdisciplinary Collaboratory for Resilience and Recovery (CRR) at RIT. The CRR works with public, private, and government entities to provide integrated information and decision support capabilities. The goal of the CRR is to increase the resilience of the surrounding community. CRR increases the community's ability to prepare, respond, and recover from disasters through integrating resiliency principles, decision support technology, and incident response capabilities. This is accomplished through educational programs and faculty, staff, and student research. RIT FMS and the CRR assisted with the development of the resilience section of this plan.

The assessment examined vulnerabilities of RIT's critical infrastructure to climate change, as well as to other potential threats such as terrorism and cyber-attacks. Terrorism and Cyber Attacks are included in the assessment to make the planning process more integrative, leveraging current efforts to reduce vulnerability to natural hazards to ensure that actions taken do not exclude considerations for man-made hazards. Strategies for adapting to Climate Change were determined by the CAP working groups based on the vulnerability assessment.

Hazards in the vulnerability assessment were derived from the County Hazard Assessment and the City of Rochester Climate Vulnerability Assessment. The hazards in the vulnerability assessment include: extreme temperatures (hot) and heat waves, extreme temperatures (cold) and severe winter storms, increased precipitation and flooding, decreased precipitation and drought, and extreme events such as wildfires, earthquakes and landslides, terrorism, and cyber-attacks.

The Department of Homeland Security defines critical infrastructure as, "sectors that compose the assets, systems, and networks, whether physical or virtual, so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof" (United States Department of Homeland Security, 2016). RIT defines its critical infrastructure as the resources and infrastructural inputs necessary for the campus to function and carry on its operations normally. RIT determined its critical infrastructure based on the 16 critical infrastructure sectors defined by the Department of Homeland Security and the 8 sectors vulnerable to natural hazards identified by the Climate Adaptation Guidebook for New York State.

The following critical infrastructure were included in the vulnerability assessment: Energy, Water, Buildings, Transportation, Ecosystems, Food and Agriculture, Health Care and Human Health, Communications and IT, Emergency Services, and Dams.

A literature review was conducted to compile a list of potential vulnerabilities to natural and man-made hazards. The review included resources such as the County Hazard Assessment, Climate Adaptation Guidebook for New York State, Homeland Security resources for each type of critical infrastructure, IPCC Reports, FEMA resources, U.S. National Climate Assessment, and Federal Highway Administration reports.

A matrix was created with RIT's Critical Infrastructure and Hazards. Vulnerabilities determined in the literature review were used to populate the matrix. The Matrixed Vulnerability Assessment was evaluated by faculty/staff involved with Risk Management on campus. Similar vulnerabilities were combined and vulnerabilities irrelevant to RIT were removed.

The working groups reviewed the Matrixed Vulnerability Assessment during the first Planning Charrette. Participants each completed a prioritization matrix to help prioritize vulnerabilities and outline adaptation strategies (Appendix A). These matrices were used to create the Prioritized Vulnerability Assessment (Table 4). Prioritization of vulnerabilities was based on four factors: severity, likelihood, ability of RIT to control, and whether or not the vulnerability is currently being addressed/managed. Vulnerabilities have been defined below.

Table 4: Prioritized Vulnerability Assessment created from first Charrette

Low	Low-Medium	Medium	Medium-High	High
• Unplanned hazardous chemical discharge resulting from hazard-related event • Increased organic waste generation • Dam failure	• Increased sewer flows • Flooding of ITS Data center based on future climate scenarios • Stability of glass interiors • Building snow loads • Emergency service access to campus during extreme event	• Decreased snow cover and river freezing • Increased freeze/thaw cycles • Increased soil erosion and damage to banks • Greater threat of invasive species • Ability to provide adequate temporary shelter • Food security • Water quality	• Energy Supply and Demand—increased demand and peak demand • Flood damage to infrastructure and drainage • Air quality impacts on health • Ecosystem health and productivity, including RIT wetlands • Higher intensity of heating and cooling degree days • Ability to hold classes during extreme events	• Increased infrastructure maintenance • Increased infrastructure disruptions due to extreme events, including grid failure • Increased heat-related health impacts • Increased diseases, vector borne illness and pests

Defining the Vulnerabilities

Ability to provide temporary shelter: RIT's field house would serve as a temporary shelter for campus residents in case of a loss of any campus housing. As such, reviewing and addressing its vulnerability to natural and man-made hazards is a priority.

Air quality: Increased temperatures and changes in weather patterns may increase the amount of ground level ozone, reducing both indoor and outdoor air quality. Increased temperatures and drought may result in more frequent and severe wildfires, which emit air pollutants such as sulfur dioxide, nitrogen dioxide, volatile organic pollutants, and fine particulates. Pollutants reduce air quality and are detrimental to human health. Decreased air quality can result in increased asthma attacks, as well as other respiratory and cardiovascular issues (U.S. Global Change Research Program, 2016). Additionally, increased temperatures and atmospheric carbon dioxide levels increases the length of allergy seasons and amount of airborne allergens (Lead, 2007).

Dam failure: Increased intensity of precipitation events and flooding will result in increased stream flows during these precipitation events. The Mount Morris Dam was built to control flooding in Rochester. Prior to the construction of the dam, Rochester experienced severe flooding events, which resulted in large amounts of property damage and a significant risk to the safety of residents. These large flood events would occur approximately once every seven years from 1865-1950 (U.S. Corps of Army Engineers). Increased streamflow from high intensity precipitation events poses an increased risk of dam failure as the climate changes (Yerramilli, 2013).

Decreased snow cover and river freezing: Increased temperatures and drought may reduce the snow cover, stream flow, and river freezing. This can have a significant impact on the ecosystem, reducing groundwater recharge and resulting in poor conditions for aquatic organisms. Decreased snow cover may increase damage to vegetation from winter deer feeding. Reduced snow cover may also change soil temperatures, affecting microbial activity, nutrient retention, and the survival of insects, plant seeds, and pathogens (Rosenzweig, et al., 2011).

Ecosystem health and productivity: The RIT campus is located in a wetland habitat. Wetlands are sensitive to changes in climate and may decline in productivity as a result of increased climate variability and drought (Rosenzweig, et al., 2011).

Emergency service access to campus during extreme event: Flooding and extreme events may prevent emergency services from accessing campus. In the 100-year and 500-year flood plain there are regions of the campus loop that would be under water. Improved stormwater management could decrease the potential for flooding in these areas, improving access of emergency services to campus. Current flood maps do not include anticipated changes in precipitation patterns, so the frequency and intensity of flooding may increase in the future.

Energy Supply and Demand: Extreme hot temperatures increase the demand and peak demand for energy. If peak demand is exceeded there could be potential brownouts or grid failure. This increased usage and solar radiation can cause increased wear and tear on infrastructure, resulting in additional costs for infrastructure repair and maintenance. Additionally, power supply can be impacted by changes in temperature, precipitation, and extreme events. Thermal efficiency of thermoelectric plants may decline, as water-cooled power plants may be impacted by increased water temperatures. Decreased reliability in hydropower could result from decreased snowmelt and increased variability in precipitation—

increased intensity of precipitation events and increased frequency of droughts. Nuclear power plants and hydropower compose approximately 55% of New York State's fuel mix (NYISO, 2017).

Flood damage to infrastructure and drainage: Flooding poses a number of potential issues for RIT due to increased amounts of stormwater runoff during heavy precipitation events. Flooding may damage infrastructure such as electricity transformers, which would severely reduce the campus' ability to function. Most infrastructure is designed based on historical data, which may leave infrastructure vulnerable to future climactic conditions.

Food security: Food Security in the United States is defined by the USDA as, "access by all people to enough food for an active, healthy life" (United States Department of Agriculture Economic Research Service, 2017). Extreme hot temperatures, floods, and droughts may result in reduced productivity, damage, and changes in distribution of primary crops such as apples, cabbage and potatoes, as well as a decline in products from livestock and fisheries. Livestock rely on grain for feed. Grain crops may decline as a result of the changing climate, reducing the grain available for feeding livestock. Increased temperatures also increase disease, decrease fertility, and reduce dairy production of livestock. Shifting climates and changes in ocean acidity are predicted to affect fish migration, increase disease among fish and reduce survival of fish. Changes in distribution of American Lobster, Red Hake and Black Sea Bass have been observed from 1968-2015 (Figure 7 (United States Environmental Protection Agency, 2016)). Additionally, RIT's supply chain may be cut off during an extreme event, or crops that RIT purchases may not be available due to decreased productivity (Figure 8, (Rosenzweig, et al., 2011)).

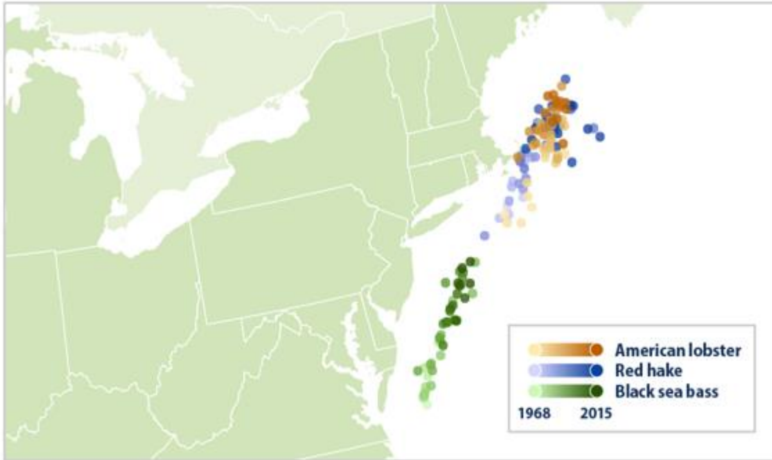


Figure 7: The figure on the right shows the average distribution of fish and shellfish from 1968-2015. (Source: EPA)

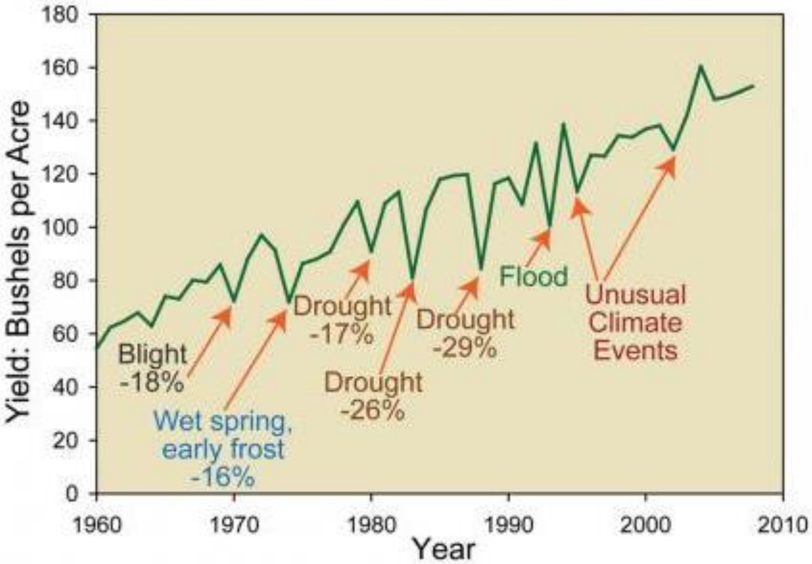


Figure 8: Historical crop yield for corn in the United States with extreme events that have significantly decreased the yield (Source: EPA)

Greater threat of invasive species: Shifting climates increase the threat of invasive species, allowing for species to thrive in environments in which they are non-native. This can severely disrupt the natural ecosystem and lead to unplanned expenses to manage the species or remove dead vegetation. RIT is already impacted by a number of invasive species. The most noticeable is the emerald ash borer. It has already killed a number of ash trees on campus and in the Rochester community.

Hazardous chemicals and materials: On the RIT campus there are hazardous chemicals and materials used in classrooms and laboratories. There could potentially be an unplanned release of these hazardous substances from a natural or man-made hazard. The Risk Management Department manages this area, so it will not be addressed in the plan.

Higher intensity of heating and cooling: Increased temperature extremes are expected to increase the intensity of heating and cooling in buildings, likely resulting in an increase in energy consumption at RIT and increased GHG emissions. Higher intensity heating and cooling days would likely increase the peak demand during summer and winter months, potentially increasing the risk of brownouts and grid failure.

Increased building loads: Buildings are currently designed to withstand specific conditions, such as wind load, temperature load, water accumulation, and snow load. Changes in climate can increase building loads, and building codes may not anticipate these future climactic conditions when setting requirements for building loads. If buildings on campus are not built to withstand these increased loads there is a potential safety issue if these loads be exceeded (Climate Change Adaptation; Steenbergen, Geurts, & Van Bentum, 2009).

Increased diseases, vector borne illness and pests: Increased temperature, precipitation and frequency of extreme events can lead to the spread of vector-borne infectious pathogens. These changes in climate increase the geographic range of vectors.

Vectors may carry diseases such as West Nile Virus and Lyme disease (Lead, 2007). The Northeastern region of the United States had a significant increase in Lyme disease cases from 1996-2014 (Figure 9). Additionally, increased temperatures and precipitation can increase exposure to waterborne pathogens, toxic algal blooms and cyanobacteria blooms. Pathogens are better able to thrive in warmer water temperatures. Also, runoff may contain pollutants and contaminate the surrounding water bodies, increasing the exposure of humans to harmful substances (Trtanj, et al., 2016).

Increased freeze/thaw cycles: More variable temperatures may increase the frequency of freeze/thaw cycles. When water freezes it expands, which can often cause damage to pavement and piping. If pipes are not buried below the frost line, or future frost line, they could burst, resulting in very costly repairs. This may impact both water and natural gas piping (Rosenzweig, et al., 2011).

Increased heat-related health impacts: Increased average temperatures and heat waves may increase heat-related health impacts. Extreme heat may result in heat stroke, dehydration, and diseases such as cardiovascular, respiratory, and cerebrovascular disease. This is of particular concern in campus buildings that are not currently air-conditioned. Northern populations are likely to be less prepared for this change, leaving these populations more vulnerable to heat-related health impacts (United State Environmental Protection Agency, 2017).

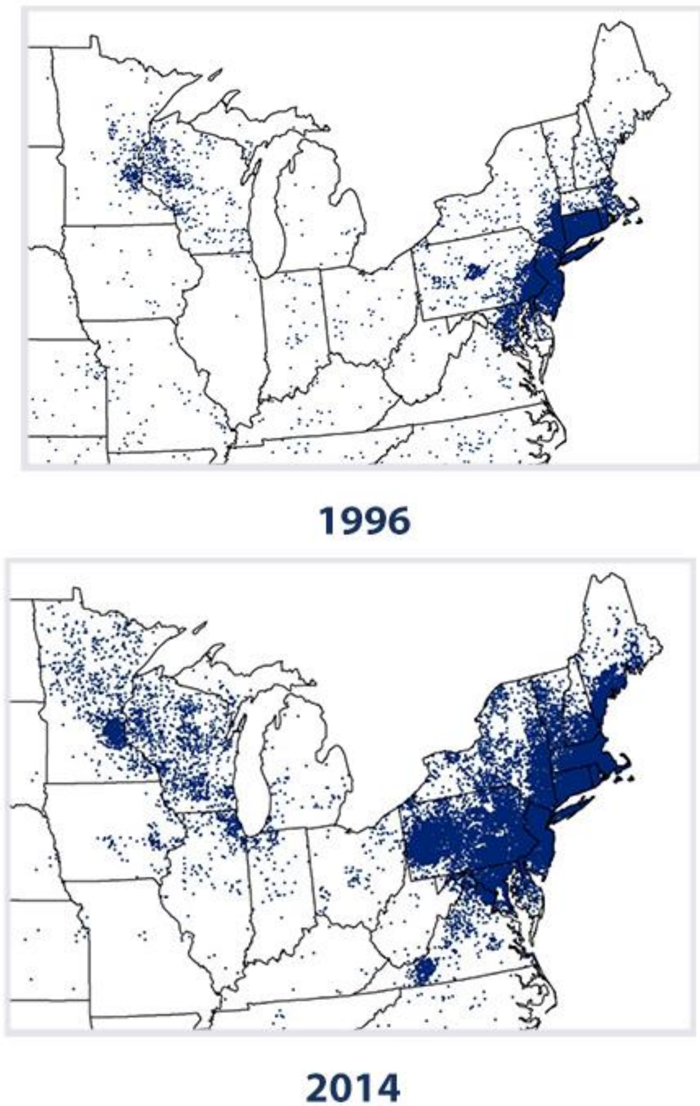


Figure 9: Reported Lyme disease Cases from in 1996 and 2014 (Source: CDC 2015 Lyme disease data and statistics)

Increased infrastructure disruptions due to extreme events, including grid failure: Extreme events may increase disruption to critical infrastructure and supplies, such as energy, food, and water. Disruption of these critical inputs may impede RIT's ability to function (2014 National Climate Assessment, 2014; National Wildlife Federation, 2011).

Increased infrastructure maintenance: Natural hazards, such as extreme temperatures, flooding, and extreme events, may cause damage and increased wear and tear on infrastructure, requiring increased infrastructure maintenance.

Increased organic waste generation: Increased temperatures and atmospheric carbon dioxide levels may result in more plant growth. Some species, such as ragweed and poison ivy, thrive in higher carbon environments (Mohan, et al., 2006). Increased plant growth will result in higher amounts of organic waste. Organic wastes landfilled are broken down anaerobically, resulting in methane, a potent GHG (United States Environmental Protection Agency, 2014). RIT will need to manage increased organic wastes properly in order to avoid increased GHG emissions. Additionally, potential future organic waste bans may require RIT to divert its food waste from the landfill.

Increased sewer flows: Increased storm and sanitary flows may result in sewer overflows, polluting the surrounding water bodies. Combined storm and sanitary sewers are especially vulnerable to overflow during flood events. RIT has separate storm and sanitary sewer systems, reducing the probability of a sewer overflow (Rosenzweig, et al., 2011).

Increased soil erosion and damage to stream banks: Increased flooding and runoff from precipitation events may increase erosion. Erosion can reduce soil quality and damage stream banks.

Additionally, landslides are more likely due to reduced stability of slopes from increased temperatures and precipitation (Rosenzweig, et al., 2011).

ITS Data Centers: RIT has two ITS data centers on campus. Two data centers allows for redundancy and operational efficiency. One of the data centers is located in a building that could be at risk of flooding during intense precipitation events in future climate scenarios.

Stability of glass interiors: RIT has built a number of LEED certified buildings on campus. Many of these buildings incorporate the Quality Views credit with floor to ceiling glass walls to give occupants a connection to the natural outdoor environment. While this improves the work environment for occupants, glass walls create the unintended consequence of increased vulnerability to violent human and natural threats.

Faculty, staff, and student ability to telecommute to during extreme event: Many organizations have invested in upgrading their infrastructure to allow for telecommuting as a form of business continuity. This allows for the organization to continue to function despite potential disruptions. RIT may want to consider upgrading its capacity for telecommuting in case an extreme event prevents faculty, staff, and students from commuting to campus.

Water quality: Increased temperature and increased runoff carrying pollutants may reduce water quality (Rosenzweig, et al., 2011). Red Creek, a tributary of the Genesee River, runs through campus. The Genesee River feeds into Lake Ontario, a major source of freshwater in New York State. Decreased water quality poses a threat to RIT's drinking water supply and the health of the aquatic ecosystem on campus, as well as in the water bodies downstream.

Goal 1 Build adaptive capacity and reduce vulnerability to Climate Change

RIT's Global Risk Management Services division has already developed plans for vulnerabilities that are not climate related. In order to increase RIT's resilience, the university will need to address its climate-related vulnerabilities. The following strategies and actions have been identified to build adaptive capacity and reduce RIT's vulnerabilities to Climate Change.

Address climate-related vulnerabilities in existing infrastructure, policies, and guidelines

- **R - 01** Update design standards to include new climactic conditions, minimize energy and resource use, and risk reduction for terrorism. These standards should be integrated into the campus master plan.
- **R - 02** Review all pipe locations to determine level of vulnerability resulting from changing freeze/thaw and drought/flooding patterns.
- **R - 03** Identify vulnerable energy infrastructure (generators, transformers, etc.) and determine if it needs to be moved higher in elevation/out of floodplain or other best course of action.
- **R - 04** Expand capabilities for telecommuting/distance learning. This would enable some level of business continuity, should an extreme weather or other event limit the RIT population's ability to get to campus for an extended period of time.
- **R - 05** Air condition all regularly occupied buildings.
- **R - 06** Have the ability to treat our own wastewater.

Enhance stormwater management strategies in landscaping, building, and transportation infrastructure design, particularly in parking lots and along roadways

R - 07 Analyze the Return on Investment (ROI) of snowmelt systems for possible expansion.
R - 08 Increase greenspace and vegetation.
R - 09 Reduce erosion through landscaping strategies and green infrastructure.
R - 10 Explore research opportunities for stormwater management and monitoring hydrology.
R - 11 Establish wetland restoration projects to increase flood buffers, enhance water retention, and improve water quality.
R - 12 Improve ability of Red Creek to handle higher flows from flooding.
R - 13 Capture water from cooling tower blow downs.
R - 14 Increase rainwater capture, storage, and reuse.
R - 15 Plant salt tolerant species along the roadway to improve water quality.
R - 16 Utilize more permeable pavement in areas requiring pavement in order to decrease stormwater runoff.

Goal 2 Reduce dependence on and increase diversity of external suppliers for critical resources

RIT has a large population of students living on campus that rely on the campus to provide essential resources. Extreme weather and increased energy demand could pose threats to the availability and delivery of essential supplies and energy to campus. Extreme weather could damage energy infrastructure and result in a grid failure. Additionally, increased energy demand could potentially surpass available peak supply, also resulting in brownouts and grid failure.

Reduce grid dependence through on-site energy generation

R - 17 Improve energy efficiencies to decrease energy demand from fixtures, appliances, heating, and cooling.
R - 18 Invest in research and academic programming on renewable energy and energy efficiency that will directly address campus challenges.
R - 19 Increase on-site renewable energy generation and other alternative forms of energy (solar, wind, hydrogen cells, passive design, geothermal, etc.).

Increase food security

R - 20 Create a separate plan to address food security and sustainability, including food production, sourcing, and research opportunities.

R·I·T

Energy

The majority of RIT's carbon emissions result from energy used during daily operations. The size of the University has increased by nearly 1.5 million square feet and 3,000 people over the last fifteen years. Because of significant energy conservation efforts undertaken by Facilities Management and RIT's commitment to green building through LEED (Leadership in Energy and Environmental Design), utility consumption has not followed suit. Figure 10 shows utility consumption and building square footage over time, these trends are explained in more detail below. However, in order to reach carbon neutrality by 2030, these efforts must be accelerated.

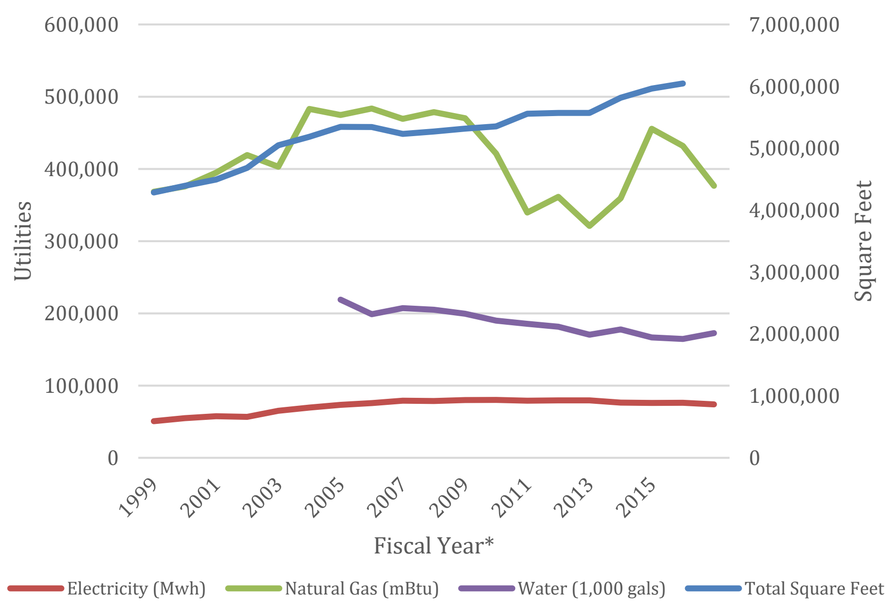


Figure 10: RIT Utility Consumption Trends

Natural Gas

At 36%, natural gas makes up the largest percentage of RIT's GHG emissions. The majority of which is used to make hot water for building heating needs. Annual natural gas and water usage both decreased noticeably after a major heating and cooling plant renovation was completed in 2009. Two centralized heating plants were installed and several building level units were removed.

The spike in gas consumption in 2014 is likely a combination of a few different factors. The winter of fiscal year (FY) of 2014, which ran from July 1, 2014 through June 30, 2015, was considerably colder than that of FY 2013. Gene Polisseni Center was also under construction through the winter of FY 2014. Natural gas heaters were used inside of the wrapped building frame in order to continue work through the colder months. Additionally, FY 2014 was the first full year of operation for the Golisano Institute for Sustainability and Institute Hall. Both opened in the second half of FY 2013. Rosica Hall also opened at the beginning of FY 2014. Heating needs and natural gas consumption declined in 2016 due to a fairly mild winter.

Electricity

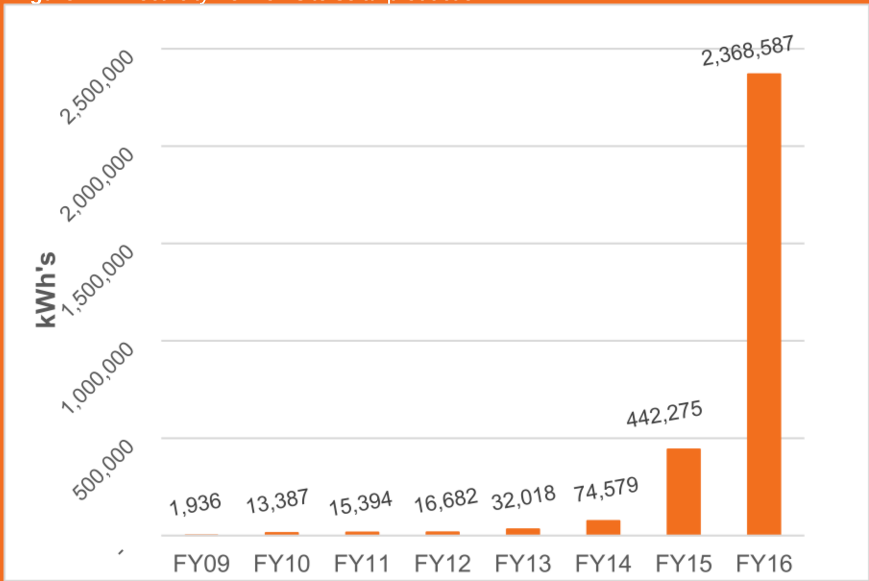
Electricity makes up another 25% of RIT's GHG emissions. The University's electrical demand ranges from 5 to 6 MW at night and averages 12.5 MW during the day, with peaks as high as 15MW in late summer. RIT has greatly expanded its solar energy generation in recent years as illustrated in Figure 11; however that generation only meets about 3% of the campus's electricity needs. The remainder is purchased and delivered to campus through two 10MW transformers. Of the university's purchased electricity, 15% is "Green-E" certified as required by campus policy.

SOLAR ENERGY ON CAMPUS

Table 5. Location and Size of RIT Solar Installations

Building	Date	Capacity (KW)
Engineering Technology Hall	Sep-08	2.22
University Services Center	Sep-09	12.42
Liberty Hill	Jan-13	10.34
Sustainability Institute	Apr-13	40.8
Field #1	May-15	1994.85
CIMS/Health Sciences Technology	Nov-15	16.775
Total		2077.405

Figure 11: Electricity from on-site solar production



Electricity consumption began leveling off in 2010 and, despite considerable growth in square footage, has gradually begun to decline. This decline is a result of a number of energy conservation measures (ECMs). ECMs include the replacement of hundreds of electric motors with high efficiency motors, fixed volume air flow systems being converted to variable volume systems, and the use of outside air for "free" cooling during colder months.

Rapidly evolving LED technology has led to a number of lighting retrofits, as well. RIT started replacing four foot T-8, 32 watt fluorescent tubes with T-8, 16 watt LED tubes. 20,000 tubes were installed in 2012 in areas where the lights were in use at least 18 hours per day. As a result of falling prices, a second round of retrofits got underway in 2016 with 5,000 tubes in areas where the lights were in use 12 hours or more per day.

Gasoline and Diesel

Fuel used in the University's fleet vehicles comprises roughly 1% of RIT's total GHG emissions. There are 142 vehicles in the University fleet, which are used for maintenance, snow removal, lawn care, catering, mail delivery and other daily operations. Vehicles include golf carts, sedans, pick-up trucks, vans, and box trucks. Table 6 below identifies the number of vehicles by fuel type.

Table 6: RIT Vehicles by Fuel Type

Fuel type	Number of vehicles
Gasoline	129
Diesel	5
Plug-in Hybrid	1
100% Electric	8

Advancing Climate Action

RIT has implemented a number of the energy related recommendations outlined in its initial CAP. Short-term energy efficiency projects, many of which are discussed above, have been completed and a University Energy Policy was adopted. Commissioning has been completed for new buildings as required by LEED; however, the initial CAP called for more in-depth commissioning, which has not consistently been employed in projects. The 2011 CAP also called for the creation of two full-time positions, an Energy Analyst and Commissioning Authority. The full-time positions were never created. This plan incorporates the previously incomplete recommendations and identifies new and more specific strategies to conserve energy and transition to renewable energy sources.

Emissions resulting from RIT's electricity usage have decreased more rapidly than electricity consumption. This is due to an increasingly cleaner fuel mix in New York's electricity grid. Aggressive emission reduction targets recently adopted by the state suggest this trend will continue (New York State, 2015). Given NY's increasingly clean electricity grid, addressing natural gas consumption and identifying a renewable alterative to natural gas is a top priority in this plan.

Goal 1 Reduce RIT's purchased energy use by 15% by 2020, 25% by 2025, and 40% by 2030

The cleanest form of energy is the energy that is never used. Thus energy conservation is the highest priority and greatest opportunity for climate action on campus. Reducing overall consumption results in cost savings and emission reductions.

Establish a University structure and focused staffing to support aggressive energy conservation

E - 01 Create a Sustainability Manager position in FMS responsible for integrating GHG reduction targets and sustainability goals into campus wide energy management planning, building design guidelines, and new construction and renovation projects. The position will also provide in house LEED Expertise, as well as energy related education and outreach to the campus community. This strategy is a carryover from the initial 2011 Climate Action Plan.

E - 02 Create a comprehensive commissioning strategy within FMS that includes commissioning training for all engineering and operations staff and requires commissioning agents to provide staff training on new or renovated buildings. A continuous commissioning approach will be established for existing building infrastructure, new construction, and renovations to maximize energy performance, asset value, life expectancy, and reduction of emissions associated with their use. This strategy is a carryover from the initial 2011 Climate Action Plan.

E - 03 Formalize an Energy Engineer role within ITS. This may be a percentage of an existing position's time, and will work with the FMS sustainability manager to advance energy conservation opportunities available through ITS equipment purchases, the Internet of Things (IOT), and related to IT infrastructure policies and settings. Energy consumption associated with IT, particularly data centers and network expansion, is projected to triple and double respectively by 2040 (United States Energy Information Administration, 2005). Therefore this will be an increasingly important area for energy conservation.

E - 04 Establish a shadow price or internal cost of carbon to accurately assess the total cost of ownership for projects.

E - 05 Develop a building controls plan to expand and upgrade infrastructure for uniform coverage. The plan will dictate the installation, monitoring, and commissioning of building controls throughout the lifecycle of buildings and identify appropriate controls by building type.

E - 06 Determine energy consumption for each individual building on campus to identify opportunities for energy reductions. Understanding energy consumption for each building will help to target poorly performing buildings for energy conservation projects and future renovations.

E - 07 Identify poorly performing buildings for future renovations. The Energy Manager will be responsible for collecting and analyzing data on building performance to identify and prioritize building renovations.

E - 08 Develop baseline building profiles by building type for: heating, cooling, lighting and plug load.

E - 09 Implement real time energy monitoring for IT infrastructure to better understand energy usage and look for opportunities to reduce energy consumption. Real-time energy monitoring can pinpoint irregularities in energy consumption to target.

E - 10 Adopt a Power Management Standard for RIT owned computers. See Appendix A.

E - 11 Install building-level metering for applicable utilities, including gas, water, electric, CHW, and MTHW. These meters will be installed in all buildings connected to the energy management system.

E - 12 Establish a revolving loan fund to rapidly advance energy conservation projects, promoting energy conservation projects on campus. Revolving loan funds are self-replenishing funds that use interest payments to fund new projects. This creates a sustainable funding source for energy conservation projects.

E - 13 Increase ability to limit building level demand. This will enable RIT to increase the number of non-essential loads that can be turned off during times of peak demand and further reduce demand charges.

Engage building occupants in energy conservation efforts

E - 14 Analyze energy use change in all apartments when policy shifted from paying real energy costs to embedding energy costs in room and board fees.

E - 15 Develop behavior change programming to encourage personal responsibility for energy conservation in administrative, academic, and residential buildings.

E - 16 Enforce existing Energy Star equipment purchasing policy and establish an internal fund for grant recipients to offset costs associated with price premiums for energy efficient/Energy Star equipment.

E - 17 Provide users real-time feedback on building performance through data visualization.

E - 18 Develop financial incentive structure to encourage colleges and departments to reduce unnecessary energy usage.

Prioritize conservation and enhancements in existing buildings and infrastructure

E - 19 Develop a schedule for deferred maintenance projects to ensure energy conservation priorities and commissioning can be integrated into those projects.

E - 20 Develop a retro-commissioning schedule for all buildings and systems.

E - 21 Connect all campus buildings to the central plant that are not already. To advance this process most cost effectively, connections should be included into any project that requires digging in those areas.

E - 22 When light bulbs are changed, they will be replaced with LEDs if fixture replacement is not required.

E - 23 Develop a priority schedule to replace windows with more efficient ones.

E - 24 Incorporate heat recovery ventilation in building retrofit projects.

E - 25 Develop plans for all existing buildings on campus to reach Net Zero, creating roadmaps for all of campus.

Reduce emissions associated with University fleet

E - 26 All new University vehicles will comply with LEED LEFE standards at a minimum.

E - 27 Develop a policy and consistent procedure for incorporating life cycle costing into vehicle purchasing decisions.

E - 28 Identify opportunities to utilize manual powered vehicles/equipment like utility tricycles where practical.

E - 29 Develop a plan to transition 80% or more fleet to alternate fuel, such electric, hydrogen, or biofuel, by 2030.

Goal 2 No net increase in carbon dioxide emissions from new buildings by 2020

The built environment is responsible for 41% of energy consumption and 40% of all GHG emissions in the United States (U.S. Department of Energy, 2012). While new buildings tend to consume less energy per square foot, they still add to overall energy consumption on campus. Therefore, addressing carbon emissions in new construction projects is essential.

Increase energy efficiency standards and specifications in new construction and renovation projects

E - 30 Develop a policy and consistent, transparent procedures for incorporating life cycle costs into building and energy infrastructure decisions.

E - 31 Require that roofs on all new buildings and retrofit projects with sufficient roof space be renewable ready, ensuring the ability to easily add solar in the future.

E - 32 Develop a net carbon neutral new building policy, requiring that any emissions resulting from the operation of a new building be avoided elsewhere on campus. The cost of the carbon mitigation (retrofitting other buildings to reduce emissions) shall be included in the construction budget of the new building.

E - 33 Establish an energy modeling template that factors in changing temperatures resulting from climate change to ensure consistency in new building energy models.

E - 34 Reinvest savings from energy efficiency projects into new energy conservation opportunities.

Goal 3 Fossil Fuel Free by 2045

Increasing on site renewable energy generation provides an added level of resilience to natural and human disturbances. Large scale infrastructure investments and changes will be necessary in order to entirely eliminate the need for fossil fuels on campus. These types of projects require significant time for research, planning, and capital allocations. Therefore the University is establishing a target date of 2045 to be fossil fuel free, later than its 2030 neutrality date.

Invest in new renewable and renewable ready technologies

E - 35 Expand on-site solar energy production to 4MW by 2020 and 6+MW by 2025.

E - 36 Install energy storage (thermal, hydrogen battery, or other).

E - 37 Install a total of 5 MW of consistent self-generation capacity available regardless of weather or sunlight.

E - 38 Install an anaerobic digester on campus using black water and other organic wastes as a feedstock to producing biogas that can be combusted to produce heat and electricity. Research and learning opportunities will be a major component of this project.

E - 39 Build distributed or central bio-fueled Combined Heat and Power (CHP) plant with absorption chiller.

E - 40 Work with state and regional government bodies to advance renewable energy policy. This may include developing a cost-effective net-metering system on campus and expanding our solar infrastructure.

Engage campus faculty and students in finding energy solutions for deployment on campus

E - 41 Identify bio-based fuel alternatives for emergency generators.

E - 42 Identify renewable fuel alternatives to Natural Gas for heating plant.

E - 43 Encourage research into advancing absorption chiller technology.

E - 44 Establish a retro-commissioning class that teaches students how to propose a building retro-commissioning project, from energy audit to design. It will provide students with realistic hands-on experience, as the provided solutions will be developed in collaboration with RIT FMS and focus on RIT buildings.

Figure 12: Solar array on roof of Sustainability Institute Hall

Figure 13: RIT 2 MW solar array

Land Use and Transportation

RIT is situated on 1099.6 acres of land. The campus includes buildings, parking lots, and athletic fields, as well as wetlands, forests, and Red Creek, a tributary of the Genesee River. The variety of land uses and ecosystems offer countless opportunities for hands-on research and learning.

In 2012 the League of American Bicyclists named RIT as a Bike Friendly University. Since that time, RIT's Student Government launched a Bike Share program, Outdoor Education opened a Bike Shop in the SAU, additional bike racks have been installed, and RIT worked with the Town of Henrietta to complete a Bike and Pedestrian Master Plan for the town.

In addition to bicycle infrastructure, RIT Parking and Transportation Services offers a free shuttle service for the campus community. Shuttles travel around campus, to RIT apartments, Residence Halls, Barnes and Noble, and the RIT Inn and Conference center. The RIT mobile application has shuttle schedules and maps with live GPS tracking, showing the current location of the shuttle. Rochester Transit Services (RTS) also services the RIT campus, with a route from campus to some off-campus apartments, the mall, grocery stores, and Downtown Rochester.

In 2016, commuting accounted for 31% of RIT's GHG emissions. Transportation initiatives offer a significant opportunity for emission reductions. If RIT were to do nothing and the number of commuters stayed the same, emissions associated with commuting would likely decrease by approximately 8,000 metric tons of carbon per year. This assumes fuel efficiency standards are not rolled back. The 2016 CAFE standards required the average fuel efficiency of cars and light-duty trucks to be 35 mpg. In 2012, the Obama

Figure 14: RIT Bikeshare Program

Figure 15: RIT shuttle Services

Administration finalized CAFE standards for 2025, requiring an average fuel efficiency of 54.5 mpg for cars and light-duty trucks RIT achieved many of the transportation recommendations in the 2011 plan. The University created low emission and fuel efficient (LEFE) and electric vehicle (EV) parking (Figure 16), increased shuttle services, improved biking infrastructure, created a university telecommuting policy, and implemented share services, such as Zipcar and bike share. EV charging infrastructure has expanded drastically in the last 3 years, as well. RIT now has 21 cords for charging electric vehicles, including 1 rapid charge tesla station. Charging stations are indicated on the interactive campus map.

Figure 16: Charging Station in "D" lot.

Transportation and commuting make up the majority of RIT's scope 3 emissions, and more than 1/3 of its total carbon footprint. Scope three emissions are much more difficult to accurately measure than scope 1 or 2 emissions though. Therefore, in addition to improvements in alternative modes of transportation, this plan outlines action items to improve the reliability of the data used in calculating scope 3 emissions.

There are a number of opportunities that exist on campus to sequester carbon and offset some of the campus's scope 3 emissions. Working with capstone students and faculty members in the Environmental Science department, RIT is developing a baseline for the amount of carbon that is currently sequestered on campus. Additionally, they are developing equations to determine sequestration by land use type based on current sampling. This will enable the university to account for changes in sequestration due to changes in land use. In other words, if a new building is constructed the carbon sequestration loss will be accounted for, and if a mowed area is converted to grassland or forest, that increase in carbon sequestration will also be accounted for. Once this baseline is complete, RIT will develop a carbon offset program that advances RIT's academic mission and engages faculty, staff, and students in offset project development, measurement, and verification.

Goal 1 Improve reliability and accuracy of data for GHG calculations by 2018

Improving reliability and accuracy of data for GHG calculations will allow RIT to gain a better understanding of the amount of emissions produced in this area and the carbon sequestration that is already occurring on campus. Currently, RIT's data on commuter emissions relies on a commuter survey, which only a small fraction of the commuter population completes. A better methodology is needed in order to accurately quantify these emissions.

Some research has been conducted on campus to understand the current carbon sequestration and sequestration potential of the soil and vegetation on campus. This research will be used to develop a baseline for sequestration. Then opportunities to increase carbon sequestration and offset GHG emissions can be identified. In addition, any loss in sequestration from construction projects on campus needs to be accounted for.

Institutionalize data collection for Scope 3 emissions

LT - 01 Add additional required questions to parking permit application, including the daily commute distance to campus, fuel type, vehicle gas mileage, and number of times per week driven to campus. This data will be used to accurately calculate emissions associated with faculty, staff and student commuting.

LT - 02 Require all charter buses to report mileage of trips.

LT - 03 Require air travel mileage to be reported on all travel expense forms.

LT - 04 Develop a database of campus trees that is accessible to the whole community.

LT - 05 Establish standard sustainability metrics for all campus vendors and suppliers that include greenhouse gas reporting.

Increase academic opportunities related to carbon accounting

LT - 06 Develop carbon maps of campus by land type to understand the amount of carbon currently sequestered on campus and develop strategies to increase sequestration. The Environmental Science department RIT currently conducts research and teaches classes related to soils and carbon sequestration. Students and faculty have begun to map (Figure 17) the carbon sequestration of soils on campus. This research will be expanded to above ground biomass.

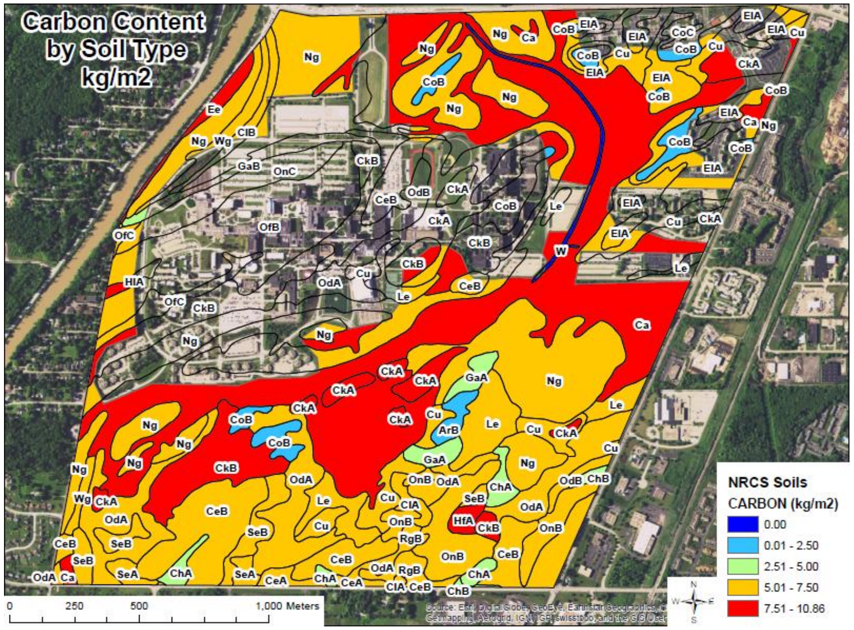


Figure 17: Map of soil carbon content on RIT campus by soil type

LT - 07 Determine the carbon input and output of different landscapes, specifically wetlands, incorporating all biomass. This will aid in the identification of potential sequestration and restoration projects on campus.

LT - 08 Improve information gathering and mapping of campus environments and species.

LT - 09 Incorporate carbon accounting projects into more classes. Carbon accounting is a new and growing field. Increasing students' knowledge of carbon accounting will provide them with an additional marketable skill.

Goal 2 Net increase in carbon sequestration on campus landscapes by 40% by 2030

RIT will work to increase carbon sequestration on campus through landscaping strategies. This will be accomplished through changes in land management practices by campus staff, as well as contracted vendors performing landscaping services.

Reduce emissions associated with landscape maintenance

- **LT - 10** Engage classes in solving campus land use challenges.
- **LT - 11** Commit to Organic Landscape Practices, i.e. no synthetic fertilizers, by 2020.
- **LT - 12** Decrease the amount of grass being mowed/watered/detailed, i.e. no mow zones.
- **LT - 13** Establish a tree replacement policy, requiring two trees to be planted on campus from an approved species list for every one tree removed.
- **LT - 14** Utilize third party programs to gain recognition for efforts, such as Bee Friendly, Tree Campus, and Sustainable Sites.

Increase carbon storage by landscape type

- **LT - 15** Narrow the perimeter of what needs to be actively maintained, especially near forested and wetland areas, allowing more natural growth.
- **LT - 16** Explore storage potential of converting felled trees/landscape waste to biochar.
- **LT - 17** Identify projects to increase soil carbon storage.
- **LT - 18** Evaluate opportunities to convert fields to forest in order to increase available biomass for carbon sequestration.

Leverage contracts and contractors

- **LT - 19** Include carbon sequestration, footprint, and neutrality goals in all campus construction, transportation, and landscape management contracts.
- **LT - 20** Change specifications and contracting requirements to include beneficial landscaping for carbon sequestration, reduced GHG emissions, and increased resilience.

Goal 3 Reduce emissions associated with commuting by 40% by 2020, 45% by 2025, and 60% by 2030

Reduce commuter vehicle emissions

- **LT - 21** Host regular events to fill tire air pressure of commuters, increasing vehicle fuel efficiency and reducing emissions.
- **LT - 22** Improve enforcement of LEFE parking spots on campus.
- **LT - 23** Develop a comprehensive strategy to encourage EV use on campus.
- **LT - 24** Require alternative-fueled or high efficiency vehicles for all on-campus shuttles in future contracts.
- **LT - 25** Track movement of commuter vehicles on campus to determine how to best manage parking areas.
- **LT - 26** Offer a carbon offset option for parking permit holders.
- **LT - 27** Quantify the impacts of the flexible work week initiative piloted by the Division of Finance and Administration (F & A) and expand the program to other areas of campus.

Increase use of alternative modes of transportation for commuting

LT - 28 Offer a parking pass for students for a remote parking lot with included bus pass to incentivize public transit.
LT - 29 Provide a ride matching software for free to the campus community to increase carpooling.
LT - 30 Expand bus routes to include more neighborhoods and areas of interest off-campus. Partner with University of Rochester and MCC to increase cost effective transit route opportunities.
LT - 31 Evaluate parking permit costs as alternative transportation options improve.

Increase active transportation infrastructure

LT - 32 Work with area municipalities and advocate for infrastructure improvements for bike and pedestrian safety.
LT - 33 Increase the amount of all-weather bike storage.
LT - 34 Require all campus shuttles be equipped with bike racks.
LT - 35 Improve campus bike/pedestrian infrastructure, including better-designed crosswalks and bike lanes on the campus loop.
LT - 36 Increase affordable housing options on campus to reduce the number of vehicles on campus and students commuting to campus.

Develop a culture of active transportation on campus

LT - 37 Better promote the Bike Repair Shop on campus and increase utilization.
LT - 38 Increase awareness of and enhance bike maps.
LT - 39 Better promote the National Bike Registry that is offered to RIT students for free through public safety's website.
LT - 40 Share more information on the percentage of groups that bike to campus and what their avoided carbon emissions are.
LT - 41 Develop incentives for cyclists.
LT - 42 Create student carpool ambassador program for off-campus housing locations.

Built Environment

The built environment plays a significant role in the University's carbon footprint. Nearly two thirds of GHG emissions are a result of the energy used to heat, cool, and run the buildings. If the embodied energy and GHG emissions of building materials and construction activities were included in RIT's carbon footprint that number would likely be closer to three fourths of the total footprint (Benjaafar, Li, & Daskin, 2012). Therefore sustainable building and operational practices are extremely important.

As part of RIT's original Climate Commitment, the university established a policy in 2009 requiring all new construction to be LEED Silver or better. Table 7 outlines all of the LEED buildings on campus and their certification levels to date. LEED buildings are also identified on the Interactive campus map under "green buildings".

Table 7: RIT LEED certified buildings

Building	Certification Level	Version	Date Certified
Engineering Technology Hall	Gold	2.2	August 2008
University Services Center	Platinum	2.2	December 2010
Global Village	Gold	2.2	July 2012
Golisano Institute for Sustainability	Platinum	3.0	March 2014
Institute Hall	Gold	2.2	October 2014
Rosica Hall	Gold	3.0	October 2014
Gene Polisseni Center	pending	3.0	

In addition to the LEED policy, the initial CAP called for the development of sustainable building guidelines. Prior to the start of

SUSTAINABILITY INSTITUTE HALL

Figure 18: Sustainability Institute Hall (Source: RIT)

Sustainability Institute Hall, home of the Golisano Institute for Sustainability, functions as a large-scale four-story testbed for numerous sustainability technologies. It features an advanced high efficiency envelope and generates more energy than is consumed through a combination of solar panels, wind turbines, geothermal, and a fuel cell configured for combined heat and power. The large green roof serves to insulate the building, aid in rain water capture, and is part of the Seneca Park Zoo's butterfly beltway project. The building was awarded LEED Platinum status in March 2014 by the United States Green Building Council.

the planning process for the CAP update, guidelines had not been created. Therefore the Built Environment Working group was charged with their development. It was quickly determined that in order to develop comprehensive sustainable building guidelines more time was needed than was available during the CAP planning process. A phased approach will instead be employed to ensure continuous progress while comprehensive standards are finalized.

Goal 1 Develop a sustainability statement and identify desired outcomes and strategies for sustainable building design and operations

This was completed during the working group sessions. Many of the specific strategies identified for the built environment overlapped with strategies also identified by the other two working groups and were therefore incorporated into those sections. The Sustainability Statement can be found on page 37.

Goal 2 Identify opportunities to most effectively utilize LEED and more efficiently manage the certification process

BE - 01 Review LEED project checklists to identify commonly achieved credits in previous projects and compare against LEED V4. Status: Complete, see Appendix B

BE - 02 Draft standardized language for each of the commonly achieved credits to reduce reporting time associated with LEED requirements on each project.

BE - 03 Update existing design guidelines with language identifying the LEED credits that all projects are expected to achieve.

BE - 04 Explore the feasibility of utilizing the LEED Campus Guidance for multiple buildings.

Goal 3 Refine strategies identified to move beyond LEED, create educational opportunities through the design and building process, and establish an annual review of sustainability standards

BE - 05 Establish Sustainable Renovation Guidelines. These would include guidance for determining when a project should seek LEED certification and ensure sustainable design standards are applied to renovations that do not seek certification.

BE - 06 Develop a process diagram that clearly identifies the sustainability requirements of each phase of the design and construction process as well responsible party for each item.

BE - 07 Formalize comprehensive guidelines that utilize both prescriptive and performance based standards and consider the use of other sustainable building standards as a baseline requirement such as Living Building Certification or the International Green Construction Code.

SUSTAINABILITY STATEMENT

Sustainability is an important consideration in university operations and building design. At the Rochester Institute of Technology, the term sustainability encompasses holistic approaches to the understanding and resolution of ecological, economic, social, and ethical problems, with the goal of working within and restoring the natural systems and resources necessary to meet the needs of the current generation in an equitable manner without jeopardizing future generations. [1]

RIT is a signatory to Second Nature's Climate Commitment (formerly the American College and University Presidents' Climate Commitment), and has committed to achieving carbon neutrality by 2030. The built environment plays a critical role in this commitment. The most recent Climate Change Vulnerability Assessment should be considered when designing or renovating any building. All new construction must be able to achieve minimum rating of LEED Silver, and the design team is encouraged to find ways to go beyond LEED.

[1] Definition developed by the Campus Environment committee of the Academic Senate in AY2013-14.

Desired outcomes for building design and operations

RIT will work to foster a healthy, accessible, and resilient environments for students, staff, and faculty through our building design and operations.

This will be accomplished through design, both new construction and building renovations and re-purposing, that:

- Creates an environment that inspires and improves the well-being of faculty, staff, and students
- Protects or restores the site and promotes ecosystem health
- Creates resilient buildings and landscapes that are prepared for natural and manmade disturbances, including those resulting from climate change
- Ensures durability through the reuse and adaptability of existing buildings as programmatic needs change
- Prioritizes the use of non-toxic, sustainable materials that are recyclable, biodegradable, rapidly renewable, and/or sourced locally
- Allows the campus community to utilize built and natural environments as living laboratories
- Optimizes the incorporation of natural (passive) building systems
- Incorporates life cycle costs and total cost of ownership into design decisions

This will be accomplished through operations that:

- Ensure healthy indoor air quality
- Employ green cleaning strategies
- Reduce energy use
- Reduce water consumption
- Minimize resource use and waste generation
- Manage the building and site for human and ecosystem health
- Provide opportunities to study building design and performance

Next Steps

Scope 3 Emissions

Not all Scope 3 emissions have been addressed in this plan, only those emissions resulting from commuting and university funded travel. The reason for this is twofold. First, the intent of this plan was to focus on areas that require longer term planning for implementation in order to get those projects underway as quickly as is economically feasible to meet the 2030 neutrality date. Commuting behavior is largely influenced by availability of infrastructure and reliability of alternative transportation options and, therefore, requires longer term planning. The second reason is because the University does not have complete information regarding emissions from the products and suppliers it utilizes.

SE - 01 By 2020, suppliers will be required to report on the emissions associated with their products and services.

SE - 02 By 2022, a procurement strategy will be developed that will drive carbon emissions reductions in RIT's supply chain.

Carbon Offsets

In order to reach RIT's goals by 2030, carbon offsets may be necessary. This is particularly likely for Scope 3 emissions. Carbon offsets are a tool that enable an entity to pay to store or reduce an equivalent amount carbon generated by an activity, when the actual emissions from that activity cannot feasibly be eliminated. Examples include tree planting, waste-to-energy projects such as anaerobic digestion, or supporting energy conservation projects off site in exchange for the GHG reductions.

CO - 01 By 2019, RIT will have a carbon offset protocol in place. The protocol will ensure that identified offsets are relevant to RIT and its mission. In other words, offsets should provide educational or research opportunities for students or faculty and/or improve the University's resilience in the face of the changing climate.

CO - 02 By 2023, an offset policy will be developed for University funded travel.

International Campuses

Businesses are responsible for their impacts wherever they operate. Following this logic, the CAP Advisory Committee determined that RIT's sustainability commitments should include its international campuses. Realizing those commitments, however, will require different approaches at each location and the emission reduction targets may differ.

IC - 01 Each international campus will establish a Sustainability Committee that will be responsible for establishing and implementing sustainability goals on their respective campus.

IC - 02 Climate Action Plans will be developed at each campus. The goals and carbon reduction targets of those plans will be identified by the stakeholders of those campuses and may differ from the reductions established for the Rochester, NY campus. Emissions reductions will be informed by already established goals within their respective countries, including those identified in the Paris Climate Accord.

Appendix A: ITS Power Management Standard v 0.1.1

Introduction

The Power Management Standard defines the requirement for power management settings that regulate when Rochester Institute of Technology (RIT) owned computers and any attached monitors go to "sleep.”

Purpose and Applicability

The purpose of the Power Management Standard is to define the power management settings on RIT owned desktop computers and/or monitors that are running operating systems capable of power management.

When a computer or monitor "sleeps," it enters a low power state, using only enough energy to quickly resume normal operations. RIT's power management settings have been developed in cooperation with the Campus Sustainability Office and work towards meeting the goals set out in the Climate Action Plan.

This standard applies to all faculty, staff, students, and labs who use RIT-owned computers or RIT-owned computers are used and/or monitors that are running an operating system with power management capabilities.

Definitions

- **Remote Desktop Connection (RDC):** A feature that allows the user to connect to a computer in another location.
- **Monitor Sleep:** The power management configuration that dictates when the monitor will enter its sleep state. This configuration is applied to all managed desktops that are not otherwise exempted as per the table below.
- **Screen Lock:** The security configuration that dictates when the OS locks and requires re-authentication to regain access. This configuration is applied to all managed desktops and laptops that are not otherwise exempted as per the table below.
- **Computer Sleep:** The power management configuration that dictates when the desktop computer will enter its sleep state. This configuration is applied to all managed desktops that are not otherwise exempted as per the table below.
- **Appropriate:** What works best for the computing environment while keeping within the spirt of minimizing energy consumption and the Climate Action Plan.

Standards and Procedures

Computer Power Profiles

RIT-owned desktop computers that are placed in one of the following three power profile categories:

- Normal
- Monitor Sleep Only
- Public Display

The computer's category governs its power management settings. See the Power Profile and Power Management table below for detail. The computer types are just a guideline and computers should follow an appropriate power profile given their use.

Power Profile and Power Management

Power Profile (Setting options in Windows)	Monitor Sleeps	System Locks	Computer Sleeps	Computer Types
Normal* (RIT - Power Management)	After 10 Minutes	After 15 Minutes	After 20 Minutes	Standard, office use computers, and lab computers that do not need to remain awake.
Monitor Only* (RIT - Power Management - Monitor Only)	After 10 Minutes	After 15 Minutes	Never	Computers that people connect to remotely or that record/serve data from/to other machines, and lab computers that need to remain awake.
Public Display* (RIT - Power Management - Public Display)	Never	Never	Never	Kiosks, instructor stations, computers used to display information to passersby while no one is actively using them.

* When appropriate or not in use, these computers and monitors should be turned off.

Exempting Your Computer from Power Management

If you need to exempt your computer from power management so that you can connect to it remotely, contact the service desk at servicedesk@rit.edu or your department system administrator if you are not ITS managed, and request the computer be added to the "Monitor Only" group. Include the name of your computer in the email.

To find the name of your computer on Windows:

1. Press the Windows key + the Pause/Break key on your keyboard.
2. Look for the "Computer name, domain, and workgroup settings" section.
3. Record the Computer name.

To find the name of your computer on Mac or Linux:

1. Open a terminal window.
2. Type *hostname*.

This will ensure that your computer is awake when you need it; however, you should turn it off when you are not planning on connecting to it remotely.

Exempting Your Computer from Screen Lock

As this is a security configuration designed to protect University users and systems from unauthorized access, there is no available exemption from this configuration. Please contact the service desk at servicedesk@rit.edu or your department system administrator if you have questions or concerns about this.

Point of Contact

Contact the service desk or your department system administrator for assistance with or power management or remote desktop connection.

Appendix B: Review of Past LEED Projects

	Past LEED Projects	Possible Points	College of Applied Science & Technology 2008	Golisano Institute for Sustainability 2011	Rosica Hall 2012	University Services Center 2013	College of Health & Science 2013	Gene Polisseni Center 2014	Suggested Silver	Suggested Gold	Reasoning
Credit	Integrative Process	**1**	0	0	0	0	0	0	1	1	Easy to include process which can lead to savings throughout the construction process.
Location and Transportation		**16**	**12**	**14**	**11**	**14**	**14**	**14**	**14**	**14**	
Credit 1	LEED for Neighborhood Development Location	16	0	0	0	0	0	0	0	0	
Credit 2	Sensitive Land Protection	1	1	1	1	1	1	1	1	1	Regularly achieved
Credit 3.1	High Priority Site - Historic District	1	0	0	0	0	0	0	0	0	
Credit 3.2	High Priority Site - Priority Designation	1	0	0	0	0	0	0	0	0	
Credit 3.3	High Priority Site - Brownfield Remediation	2	0	0	0	0	0	0	0	0	
Credit 4.1.1	Surrounding Density and Diverse Uses - Surrounding Density - 22000 sf/acre. Residential 7 DU/acre, Nonresidential 0.5 FAR	2	0	0	0	0	0	0	0	0	
Credit 4.1.2	Surrounding Density and Diverse Uses - Surrounding Density - 35000 sf/acre. Residential 12 DU/acre, Nonresidential 0.8 FAR	3	3	3	3	3	3	3	3	3	Regularly achieved
Credit 4.2.1	Surrounding Density and Diverse Uses - Diverse Uses - 4-7 main entrances within 1/2 mile of main entrance	1	0	0	0	0	0	0	0	0	
Credit 4.2.2	Surrounding Density and Diverse Uses - Diverse Uses - ≥ 8 main entrances within 1/2 mile of main entrance	2	2	2	2	2	2	2	2	2	Regularly achieved
Credit 5.1	Access to Quality Transit - Weekday Trips - 72, Weekend trips - 40	1	0	0	0	0	0	0	0	0	
Credit 5.2	Access to Quality Transit - Weekday Trips - 144, Weekend trips - 108	3	0	0	0	0	0	0	0	0	
Credit 5.3	Access to Quality Transit - Weekday Trips - 360, Weekend trips - 216	5	5	5	5	5	5	5	5	5	Regularly achieved
Credit 6	Bicycle Facilities	1	1	1	0	1	1	1	1	1	Regularly achieved
Credit 7	Reduced Parking Footprint	1	0	1	0	1	1	1	1	1	Regularly achieved
Credit 8.1	Green Vehicles - Electric Vehicle Charging	1	0	1	0	1	1	1	1	1	Regularly achieved

	Past LEED Projects		College of Applied Science & Technology	Golisano Institute for Sustainability	Rosica Hall	University Services Center	College of Health & Science	Gene Polisseni Center	Suggested Silver	Suggested Gold	
		Possible Points	2008	2011	2012	2013	2013	2014			Reasoning
Credit 8.2	Green Vehicles - Liquid, Gas, or Battery Facilities	1	0	0	0	0	0	0	0	0	
Sustainable Sites		**10**	**4**	**8**	**2**	**4**	**2**	**1**	**7**	**8**	
Prereq 1	Construction Activity Pollution Prevention	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Credit 1	Site Assessment	1	?	1	?	?	?	0	1	1	Regularly achieved
Credit 2.1	Site Development - Protect or Restore Habitat - On-Site Restoration	2	0	1	0	0	0	0	0	0	
Credit 2.2	Site Development - Protect or Restore Habitat - Financial Support	1	0	0	0	0	0	0	0	0	
Credit 3	Open Space	1	1	1	1	1	1	0	1	1	Regularly achieved
Credit 4.1.1	Rainwater Management - Percentile of Rainfall Events - 95th Percentile	2	?	2	0	0	0	0	2	0	Climate change increasing the potential for extreme rainfall events. This is important for resilience,
Credit 4.1.2	Rainwater Management - Percentile of Rainfall Events - 98th Percentile	3	0	0	0	0	0	0	0	3	Climate change increasing the potential for extreme rainfall events. This is important for resilience,
Credit 4.1.3	Rainwater Management - Percentile of Rainfall Events - Zero Lot Line Projects Only – 85th Percentile	3	0	0	0	0	0	0	0	0	
Credit 4.2	Rainwater Management - Natural Land Cover Conditions	3	0	0	0	0	0	0	0	0	
Credit 5.1	Heat Island Reduction - Nonroof and Roof	2	2	2	0	2	0	0	2	2	Regularly achieved
Credit 5.2	Heat Island Reduction - Parking Under Cover	1	0	0	0	0	0	0	0	0	
Credit 6.1	Light Pollution Reduction - BUG Rating Method	1	0	0	0	0	0	0	0	0	
Credit 6.2	Light Pollution Reduction - Calculation Method	1	1	1	1	1	1	1	1	1	Regularly achieved
Water Efficiency		**11**	**8**	**7**	**5**	**4**	**5**	**5**	**7**	**8**	
Prereq 1	Outdoor Water Use Reduction	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Prereq 2	Indoor Water Use Reduction	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Prereq 3	Building-Level Water Metering	Required	?	Y	?	?	?	?	Y	Y	Required
Credit 1.1	Outdoor Water Use Reduction - No Irrigation Required	2	2	2	2	2	2	2	2	2	Regularly achieved
Credit 1.2.1	Outdoor Water Use Reduction - Reduced Irrigation - 50%	1	0	0	0	0	0	0	0	0	
Credit 1.2.2	Outdoor Water Use Reduction - Reduced Irrigation - 100%	2	0	0	0	0	0	0	0	0	

	Past LEED Projects		College of Applied Science & Technology	Golisano Institute for Sustainability	Rosica Hall	University Services Center	College of Health & Science	Gene Polisseni Center	Suggested Silver	Suggested Gold	
		Possible Points	2008	2011	2012	2013	2013	2014			Reasoning
Credit 2.1	Indoor Water Use Reduction - 25%	1	0	0	0	0	0	0	0	0	
Credit 2.2	Indoor Water Use Reduction - 30%	2	0	0	0	2	0	0	0	0	
Credit 2.3	Indoor Water Use Reduction - 35%	3	0	0	3	0	3	3	0	0	
Credit 2.4	Indoor Water Use Reduction - 40%	4	0	4	0	0	0	0	4	0	Oportunities to further offset potable water use through using grey water.
Credit 2.5	Indoor Water Use Reduction - 45%	5	0	0	0	0	0	0	0	5	Oportunities to further offset potable water use through using grey water.
Credit 2.6	Indoor Water Use Reduction - 50%	6	6	0	0	0	0	0	0	0	
Credit 3.1	Cooling Tower Water Use - Maximum number of cycles achieved without exceeding any filtration levels or affecting operation of condenser water system (up to maximum of 10 cycles)	1	?	?	?	?	?	?	0	0	
Credit 3.2	Cooling Tower Water Use - Achieve a minimum 10 cycles by increasing the level of treatment in condenser or make-up water	2	?	?	?	?	?	?	0	0	
Credit 3.3	Cooling Tower Water Use - Meet the minimum number of cycles to earn 1 point and use a minimum 20% recycled nonpotable water	2	?	?	?	?	?	?	0	0	
Credit 4	Water Metering	1	0	1	0	0	0	0	1	1	Important for later verification and continued monitoring of our buildings' water performance.
Energy and Atmosphere		**33**	**12**	**26**	**19**	**11**	**14**	**14**	**15**	**22**	
Prereq 1	Fundamental Commissioning and Verification	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Prereq 2	Minimum Energy Performance	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Prereq 3	Building-Level Energy Metering	Required	Y	Y	?	Y	Y	Y	Y	Y	Required
Prereq 4	Fundamental Refrigerant Management	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Credit 1.1.1	Enhanced Commissioning - Enhanced Systems Commissioning - Enhanced Commissioning	3	3	0	3	0	0	0	0	3	Is an additional process/procedure that verifies the systems functioning.
Credit 1.1.2	Enhanced Commissioning - Enhanced Systems Commissioning - Enhanced and Monitoring-Based Commissioning	4	0	4	0	0	0	0	0	0	

	Past LEED Projects	Possible Points	College of Applied Science & Technology 2008	Golisano Institute for Sustainability 2011	Rosica Hall 2012	University Services Center 2013	College of Health & Science 2013	Gene Polisseni Center 2014	Suggested Silver	Suggested Gold	Reasoning
Credit 1.2	Enhanced Commissioning - Envelope Commissioning	2	0	2	0	0	0	0	0	2	Is an additional process/procedure that verifies the systems functioning.
Credit 2.1.1	Optimize Energy Performance - 6%	1	0	0	0	0	0	0	0	0	
Credit 2.1.2	Optimize Energy Performance - 8%	2	0	0	0	0	0	0	0	0	
Credit 2.1.3	Optimize Energy Performance - 10%	3	0	0	0	0	0	0	0	0	
Credit 2.1.4	Optimize Energy Performance - 12%	4	0	0	0	0	0	0	0	0	
Credit 2.1.5	Optimize Energy Performance - 14%	5	0	0	0	0	0	0	0	0	
Credit 2.1.6	Optimize Energy Performance - 16%	6	0	0	0	0	0	0	0	0	
Credit 2.1.7	Optimize Energy Performance - 18%	7	0	0	0	0	0	0	0	0	
Credit 2.1.8	Optimize Energy Performance - 20%	8	8	0	0	0	0	0	0	0	
Credit 2.1.9	Optimize Energy Performance - 22%	9	0	0	0	0	0	0	0	0	
Credit 2.1.10	Optimize Energy Performance - 24%	10	0	0	0	10	0	0	0	0	
Credit 2.1.11	Optimize Energy Performance - 26%	11	0	0	0	0	0	0	0	0	
Credit 2.1.12	Optimize Energy Performance - 29%	12	0	0	0	0	12	12	12	0	Regularly achieved
Credit 2.1.13	Optimize Energy Performance - 32%	13	0	0	0	0	0	0	0	0	
Credit 2.1.14	Optimize Energy Performance - 35%	14	0	0	0	0	0	0	0	14	A slight increase in energy performance which should be undertaken.
Credit 2.1.15	Optimize Energy Performance - 38%	15	0	15	15	0	0	0	0	0	
Credit 2.1.16	Optimize Energy Performance - 42%	16	0	0	0	0	0	0	0	0	
Credit 2.1.17	Optimize Energy Performance - 46%	17	0	0	0	0	0	0	0	0	
Credit 2.1.18	Optimize Energy Performance - 50%	18	0	0	0	0	0	0	0	0	
Credit 2.2	Optimize Energy Performance - Prescriptive Compliance: ASHRAE Advanced Energy Design Guide	6	0	0	0	0	0	0	0	0	
Credit 3	Advanced Energy Metering	1	0	1	0	0	0	1	1	1	Important for later verification and continued monitoring of our buildings' energy performance.
Credit 4.1	Demand Response - Demand Response Program Available	2	0	0	0	0	0	0	0	0	

	Past LEED Projects		College of Applied Science & Technology	Golisano Institute for Sustainability	Rosica Hall	University Services Center	College of Health & Science	Gene Polisseni Center	Suggested Silver	Suggested Gold	
		Possible Points	2008	2011	2012	2013	2013	2014			Reasoning
Credit 4.2	Demand Response - Demand Response Program Not Available	1	0	0	0	0	0	0	0	0	
Credit 5.1	Renewable Energy Production -1%	1	0	1	0	0	1	0	1	1	Renewable energy production in the form of PVs, or other, should become standard practice when constructing new buildings. Whether on the roof or added to our solar farm.
Credit 5.2	Renewable Energy Production - 5%	2	0	0	0	0	0	0	0	0	
Credit 5.3	Renewable Energy Production - 10%	3	0	0	0	0	0	0	0	0	
Credit 6.1	Enhanced Refrigerant Management - No Refrigerants or Low-Impact Refrigerants	1	1	1	1	1	1	1	1	1	Regularly achieved
Credit 6.2	Enhanced Refrigerant Management -Calculation of Refrigerant Impact	1	0	0	0	0	0	0	0	0	
Credit 7.1	Green Power and Carbon Offsets - 50%	1	0	0	0	0	0	0	0	0	
Credit 7.2	Green Power and Carbon Offsets - 100%	2	0	2	0	0	0	0	0	0	
Materials and Resources		**13**	**2**	**6**	**3**	**2**	**2**	**2**	**3**	**3**	
Prereq 1	Storage and Collection of Recyclables	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Prereq 2	Construction and Demolition Waste Management Planning	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Credit 1	Building Life-Cycle Impact Reduction	5	0	0	0	0	0	0	0	0	
Credit 2.1	Building Product Disclosure and Optimization - Environmental Product Declarations	1	1	1	1	1	1	1	1	1	
Credit 2.2	Building Product Disclosure and Optimization - Environmental Product Declarations - Multi-Attribute Optimization	1	0	0	0	0	0	0	0	0	
Credit 3.1	Building Product Disclosure and Optimization - Sourcing of Raw Materials - Raw Material Source and Extraction Reporting	1	0	1	0	0	0	0	0	0	
Credit 3.2	Building Product Disclosure and Optimization - Sourcing of Raw Materials - Leadership Extraction Practices	1	0	1	0	0	0	0	0	0	
Credit 4.1	Building Product Disclosure and Optimization - Material Ingredients Reporting	1	0	1	0	0	0	0	0	0	

	Past LEED Projects		College of Applied Science & Technology	Golisano Institute for Sustainability	Rosica Hall	University Services Center	College of Health & Science	Gene Polisseni Center	Suggested Silver	Suggested Gold	
		Possible Points	2008	2011	2012	2013	2013	2014			Reasoning
Credit 4.2	Building Product Disclosure and Optimization - Material Ingredients Optimization	1	0	0	0	0	0	0	0	0	
Credit 4.3	Building Product Disclosure and Optimization - Material Ingredients - Product Manufacturer Supply Chain Optimization (only 2 of 3 countable)	1	0	0	0	0	0	0	0	0	
Credit 5.1.1	Construction and Demolition Waste Management - Diversion - 50% and 3 Material Streams	1	1	0	0	1	1	1	0	0	
Credit 5.1.2	Construction and Demolition Waste Management - Diversion - 75% and 4 Material Streams	2	0	2	2	0	0	0	2	2	As demolition is not a large component of our construction process this credit should be pursued.
Credit 5.2	Construction and Demolition Waste Management - Reduction of Total Waste Material	2	0	0	0	0	0	0	0	0	
Indoor Environmental Quality		**16**	**8**	**10**	**7**	**5**	**6**	**7**	**7**	**7**	
Prereq 1	Minimum Indoor Air Quality Performance	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Prereq 2	Environmental Tobacco Smoke Control	Required	Y	Y	Y	Y	Y	Y	Y	Y	Required
Credit 1.1	Enhanced Indoor Air Quality Strategies - Enhanced IAQ Strategies	1	1	1	1	1	1	1	1	1	Regularly achieved
Credit 1.2	Enhanced Indoor Air Quality Strategies - Additional Enhanced IAQ Strategies	1	0	0	0	0	0	1	0	0	
Credit 2.1	Low-Emitting Materials - Product Category Calculations	3	3	0	3	3	3	3	3	3	Regularly achieved
Credit 2.2.1	Low-Emitting Materials - Budget Calculation Method - ≥ 50% and < 70%	1	0	0	0	0	0	0	0	0	
Credit 2.2.2	Low-Emitting Materials - Budget Calculation Method - ≥ 70% and < 90%	2	0	0	0	0	0	0	0	0	
Credit 2.2.3	Low-Emitting Materials - Budget Calculation Method - ≥ 90%	3	0	3	0	0	0	0	0	0	
Credit 3	Construction Indoor Air Quality Management Plan	1	0	1	1	1	1	1	1	1	Regularly achieved
Credit 4.1	Indoor Air Quality Assessment - Flush-Out	1	0	0	0	0	0	0	0	0	
Credit 4.2	Indoor Air Quality Assessment - During Occupancy	1	0	0	0	0	0	0	0	0	

	Past LEED Projects	Possible Points	College of Applied Science & Technology 2008	Golisano Institute for Sustainability 2011	Rosica Hall 2012	University Services Center 2013	College of Health & Science 2013	Gene Polisseni Center 2014	Suggested Silver	Suggested Gold	Reasoning
Credit 4.3	Indoor Air Quality Assessment - Air Testing	2	0	0	0	0	0	0	0	0	
Credit 5.1	Thermal Comfort - ASHRAE Standard 55-2010	1	1	0	1	0	1	1	1	1	Regularly achieved
Credit 5.2	Thermal Comfort - ISO and CEN Standards	1	0	0	0	0	0	0	0	0	
Credit 6.1	Interior Lighting - Lighting Control	1	0	1	1	0	0	0	1	1	Lighting control is a cheap and easy addition to add to any project.
Credit 6.2	Interior Lighting - Lighting Quality	1	0	0	0	0	0	0	0	0	
Credit 7.1.1	Daylight - Simulation: Spatial Daylight Autonomy and Annual Sunlight Exposure 55%	2	0	0	0	0	0	0	0	0	
Credit 7.1.2	Daylight - Simulation: Spatial Daylight Autonomy and Annual Sunlight Exposure 75%	3	0	3	0	0	0	0	0	0	
Credit 7.2.2	Daylight - Simulation: Illuminance Calculations 75%	1	0	0	0	0	0	0	0	0	
Credit 7.2.3	Daylight - Simulation: Illuminance Calculations 90%	2	0	0	0	0	0	0	0	0	
Credit 7.3.1	Daylight - Measurement 75%	2	2	0	0	0	0	0	0	0	
Credit 7.3.2	Daylight - Measurement 90%	3	0	0	0	0	0	0	0	0	
Credit 8	Quality Views	1	1	1	0	0	0	0	0	0	
Credit 9	Acoustic Performance	1	0	0	0	0	0	0	0	0	
Innovation		**6**	**5**	**6**	**2**	**2**	**1**	**5**	**2**	**2**	
Credit 1.1	Innovation - Innovation	1	1	1	1	1	0	1	1	1	Regularly achieved
Credit 1.2	Innovation - Pilot	1	0	1	0	0	0	0	0	0	
Credit 1.3.1	Innovation - Additional Strategies - Innovation	3	2	3	0	0	0	3	0	0	
Credit 1.3.2	Innovation - Additional Strategies - Pilot	3	0	0	0	0	0	0	0	0	
Credit 1.3.3	Innovation - Additional Strategies - Exemplary Performance	2	1	0	0	0	0	0	0	0	
Credit 2	LEED Accredited Professional	1	1	1	1	1	1	1	1	1	Regularly achieved
Regional Priority		**4**	**0**	**4**	**0**	**2**	**1**	**1**	**0**	**0**	
Credit 1	Regional Priority: Specific Credit	1	0	1	0	1	1	1	0	0	Should be pursued where available but not expected as they vary over time,
Credit 2	Regional Priority: Specific Credit	1	0	1	0	1	0	0	0	0	

	Past LEED Projects	Possible Points	College of Applied Science & Technology	Golisano Institute for Sustainability	Rosica Hall	University Services Center	College of Health & Science	Gene Polisseni Center	Suggested Silver	Suggested Gold	Reasoning
		Possible Points	2008	2011	2012	2013	2013	2014			Reasoning
Credit 3	Regional Priority: Specific Credit	1	0	1	0	0	0	0	0	0	
Credit 4	Regional Priority: Specific Credit	1	0	1	0	0	0	0	0	0	
TOTALS	Possible Points:	**110**	**51**	**81**	**49**	**44**	**45**	**49**	**56**	**65**	
	Previous Points:	110	41*	85	67	55	54	50			

Certified: 40 to 49 points**,** **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

*LEED v2.2 Gold: 39-51 points

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Appendix C: Draft LEED Requirements

Y	?	N			
			Credit	Integrative Process	**1**

Y	?	N			
13	**1**	**0**	**Location and Transportation**		**16**
			Credit	LEED for Neighborhood Development Location	16
1			Credit	Sensitive Land Protection	1
			Credit	High Priority Site	2
5			Credit	Surrounding Density and Diverse Uses	5
5			Credit	Access to Quality Transit	5
1			Credit	Bicycle Facilities	1
1			Credit	Reduced Parking Footprint	1
	1		Credit	Green Vehicles	1
7	**0**	**0**	**Sustainable Sites**		**10**
Y			Prereq	Construction Activity Pollution Prevention	Required
1			Credit	Site Assessment	1
			Credit	Site Development - Protect or Restore Habitat	2
1			Credit	Open Space	1
2			Credit	Rainwater Management	3
2			Credit	Heat Island Reduction	2
1			Credit	Light Pollution Reduction	1
7	**1**	**0**	**Water Efficiency**		**11**
Y			Prereq	Outdoor Water Use Reduction	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
2			Credit	Outdoor Water Use Reduction	2
4			Credit	Indoor Water Use Reduction	6
	1		Credit	Cooling Tower Water Use	2
1			Credit	Water Metering	1

Y	?	N			
15	**2**	**0**	**Energy and Atmosphere**		**27**
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
13			Credit	Optimize Energy Performance	18
1			Credit	Advanced Energy Metering	1
	2		Credit	Demand Response	2
			Credit	Renewable Energy Production	3
1			Credit	Enhanced Refrigerant Management	1
			Credit	Green Power and Carbon Offsets	2
3	**0**	**0**	**Materials and Resources**		**13**
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
			Credit	Building Life-Cycle Impact Reduction	5
1			Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
			Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
			Credit	Building Product Disclosure and Optimization - Material Ingredients	2
2			Credit	Construction and Demolition Waste Management	2

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Y	?	N	Category	Credit	Points
7	**0**	**0**	**Indoor Environmental Quality**		**16**
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
1			Credit	Enhanced Indoor Air Quality Strategies	2
3			Credit	Low-Emitting Materials	3
1			Credit	Construction Indoor Air Quality Management Plan	1
			Credit	Indoor Air Quality Assessment	2
1			Credit	Thermal Comfort	1
1			Credit	Interior Lighting	2
			Credit	Daylight	3
			Credit	Quality Views	1
			Credit	Acoustic Performance	1
2	**0**	**0**	**Innovation**		**6**
1			Credit	Innovation	5
1			Credit	LEED Accredited Professional	1
1	**0**	**0**	**Regional Priority**		**4**
1			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
55	**4**	**0**	**TOTALS**	Possible Points:	**104**

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

Glossary

Adaptation: Strategies and actions to build capacity to respond to hazards. Climate adaptation includes strategies and actions that reduce vulnerability to hazards posed by Climate Change.

Carbon Neutrality: For purposes of the Carbon and Climate Commitments, carbon neutrality is defined as having no net greenhouse gas emissions, to be achieved by minimizing greenhouse gas emissions as much as possible, and using carbon offsets or other measures to mitigate the remaining emissions (Second Nature).

Carbon Sequestration: The process of removing carbon dioxide from the atmosphere and storing it. Planting trees is one way in which carbon dioxide is commonly sequestered. Trees use carbon dioxide in photosynthesis to produce biomass, capturing the carbon dioxide and turning it into a solid form.

Carbon Sink: A reservoir for carbon sequestered from the atmosphere. Two examples of large carbon sinks are forests and oceans.

Carbon Offset: A reduction in carbon dioxide emissions made to compensate for greenhouse gas emissions. Organizations often purchase these to reduce their net greenhouse gas emissions.

Corporate Average Fuel Economy (CAFE): Federal regulations put in place to regulate the minimum average fuel economy of cars and light-duty trucks. This standard was created to reduce the greenhouse gas emissions associated with vehicles.

Electric Vehicle (EV): A vehicle that is propelled by one or more electric motors. All electric vehicles (AEV) may be powered by battery or fuel cell.

"Green-e": A program standard by the non-profit organization Center for Resource Solutions that advocates for and supports the development of clean energy and carbon offset certification. Green-e assists with standards such as LEED, B Corporation, and Cradle to Cradle.

Hazard: A danger or risk. Hazards can be natural or man-made. Hurricanes, floods, landslides, and severe storms are examples of natural hazards, while terrorism and cyber-attacks are examples of man-made hazards.

Kyoto Protocol: In 1992, the United Nations Framework Convention on Climate Change took place. The United Nations Framework Convention on Climate Change created an international treaty, the Kyoto Protocol, aimed at reducing greenhouse gas emissions. The Kyoto Protocol set greenhouse gas emission reduction targets for 2012 based on the premise that Climate Change is occurring as a result of greenhouse gas emissions from human activities and is a threat to the health and wellbeing of humans.

Low Emission, Fuel Efficient (LEFE): Vehicles that emit relatively low levels of emissions from fossil fuel combustion and have high fuel combustion efficiency, i.e. a high fuel economy.

Leadership in Energy and Environmental Design (LEED): A green building certification offered through the United States Green Building Council (USGBC). Four certification levels are available for buildings: Certified, Silver, Gold, and Platinum. The standard is broken down into 8 sections: Location and Transportation, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation, and Regional Priority. The standard ensures that both social and environmental aspects of sustainability are incorporated into building design and operation. LEED is one of the most commonly used green building certifications in the United States.

Million Tons of Carbon Dioxide Equivalent (MTCO2e): A common unit used to measure greenhouse gas emissions. Greenhouse gases have varying Global Warming Potentials (GWP). For example, methane has a larger GWP than carbon dioxide, so when given equal amounts methane and carbon dioxide the methane will contribute more to global warming. These greenhouse gases can be converted to using their GWP to the equivalent amount of carbon dioxide.

Mitigation: Strategies and actions taken towards reducing the impacts on an issue. Climate Change mitigation include strategies and actions taken to reduce greenhouse gas emissions, therefore reducing the impact on Climate Change.

Paris Climate Accord (Paris Agreement): The United Nations Framework Convention on Climate Change agreement focused on mitigation, adaptation, and finance for action in response to Climate Change. The agreement is the first universal, legally binding climate agreement. Parties that ratify the agreement are committing to limiting global warming to well below 2°C, ideally limiting the increase to 1.5°C.

Renewable Energy Certificate (REC): RECs can be purchased to reduce greenhouse gas emissions from electricity consumption. A REC market allows for RECs to be sold and traded. These certificates allow for the purchase of renewable energy from various regions around the country. Purchasers are able claim the amount of energy associated with the REC as renewable energy and lower the purchasers' net greenhouse gas emissions.

Resilience: The ability to adapt to and recover from hazards, shocks, or stresses and restore long-term functionality. Climate resilience would therefore be the capacity to adapt and recover from hazards posed by Climate Change.

Scope 1: Direct greenhouse gas emissions produced from on-site combustion or application. These include sources such as natural gas combustion, fleet vehicles, fertilizer application, and refrigerants and chemicals.

Scope 2: Indirect greenhouse gas emissions produced from purchased electricity.

Scope 3: Indirect greenhouse gas emissions that are a consequence of the activities of the institution, but occur from sources not owned or controlled by the institution. These may include emissions from sources such as emissions from transmission and distribution losses of natural gas and electricity, commuting and travel, solid waste disposal, and wastewater treatment.

Vulnerability: A state that makes an individual or group susceptible to a hazard. The individual or group lacks the capacity to appropriately respond to the given hazard.

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