Net Zero Plan for Harper College

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Submitted: April 8, 2021

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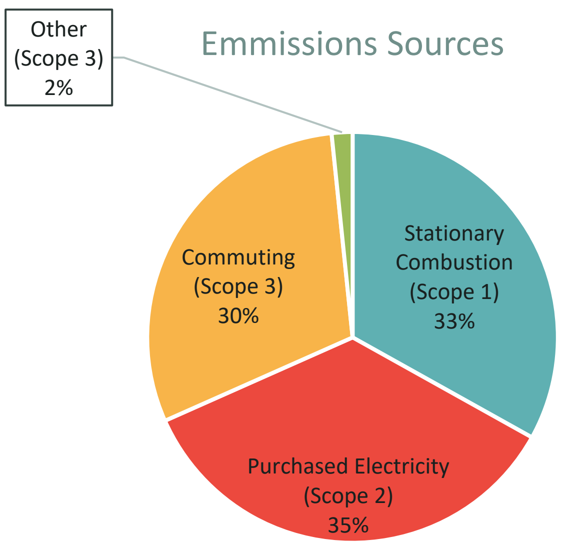
1 EXECUTIVE SUMMARY

Harper College seeks to combat global warming and contribute to a sustainable future for its facilities by reaching net-zero emissions by 2053. The net zero project demonstrates Harper College's commitment to a sustainable future while realizing immediate, significant energy cost savings. The Smart Energy Design Assistance Center (SEDAC) is partnering with the Illinois Green Economy Network (IGEN) to provide technical assistance to IGEN community colleges to review, develop, and update their Net Zero Plans.

This report describes SEDAC's investigations and findings related to mitigation of Harper College's most significant emissions categories: building energy use, commuting, and services & operations. SEDAC has worked with the college to provide recommendations on measures to reduce emissions and to sustainably generate power on site. Together, these recommendations constitute a roadmap to net zero emissions by 2053.

Emissions inventory

To identify measures to reach net zero, we first completed an emissions inventory of the existing operations and energy use at Harper College. Harper's emissions are nearly evenly divided between on-site combustion through the boiler system, purchased electricity, and student and staff commuting. Other emission sources such as wastewater, mobile combustion, and air travel at present are minimal by comparison. Figure 1 breaks down energy use by sector.



To project emissions into the future, we considered how operations have been trending in the last 6 years. The number of students has been fairly flat with a slight decrease recently, counteracted by the growth of campus square footage. This suggests that a business-as-usual future emissions scenario is likely to see slowly increasing emissions for the college, as shown in figure 2, primarily due to growth in campus building square footage. The spike in 2018 appears to be weather and construction related.

Figure 1: Emissions by Category

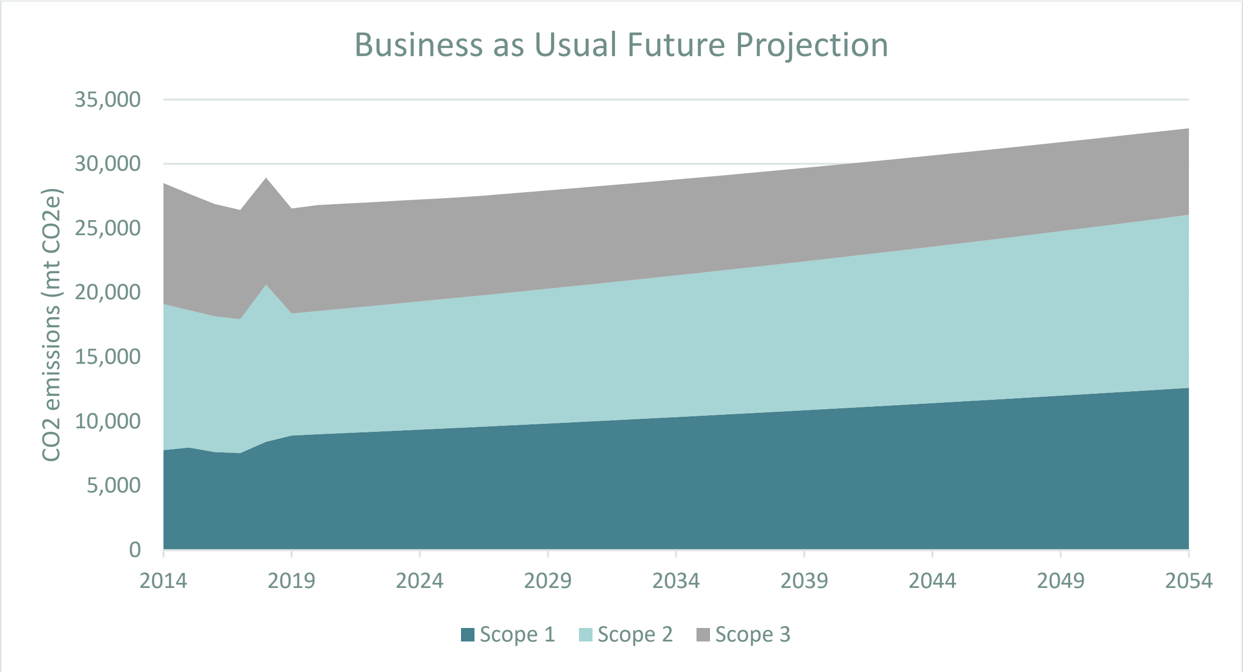


Figure 2 Harper College Annual Carbon Emission Projected to 2054

Reducing emissions

We employ a 'conserve and load' strategy of energy conservation to reduce the overall energy use in the facility, then we satisfy the much more manageable load with renewable energy resources. Total emissions can be reduced by nearly 75%, saving about 20,000 metric tons of carbon annually including conservation, efficiency, and offsets. The remaining 25% of emissions can be offset with solar installations, purchase of renewable electricity and carbon offsets. Below we describe a phased approach to implementing measures to achieve zero emissions by 2053. Phase 1 was covered by Harper's previous climate action plan in 2013.

The path to net zero contains a few benchmarks along the way with a 17% reduction during phase 2 by 2032, 66% reduction during phase 3 by 2042, and the final 17% reduction during phase 4 by 2053.

Phase 2 focuses on low capital cost, easy-to-implement measures (2022-2032).

Phase 3 focuses on moderate capital cost and complexity measures (2033-2042). During phases 2 and 3, we recommend developing rooftop solar arrays of 4,000kW to provide the feasible onsite renewable electricity.

Phase 4 focuses on high capital cost and high complexity measures (2043-2053). The proposed measures represent transformational, out-of-the-box thinking and will require Harper College to consider potential new policy directions. We also recommend eliminating natural gas and diesel vehicles and switching to electric vehicles, powered by solar or other renewable electricity during phase 4.

Timeline

Figure 3 summarizes our proposed phased approach for implementation of the measures to achieve net zero. The annual CO_2 reductions are provided for reference and are based on a 2019 baseline. The reductions will increase as the business-as-usual emissions increase. MT is an abbreviation of metric ton of CO_2 equivalency.

Phase 2: 2022-2032 [CO_2 Reductions]	Phase 3: 2033-2042	Phase 4: 2043-2053
Retrocommission buildings [900MT]		
Implement DCV [360MT]		
Reduce exhaust [360MT]		
Turn off central heating system during summer [360 MT]		
Online/hybrid courses [180MT]		
Car/vanpool [90MT]		
Low carbon travel [90MT]		
Minimize travel [90MT]		
Right Size fleet [4MT]		
Reduce land requiring maintenance [4MT]		
Electronic document transmission [unknown]		
Install electric vehicle charging infrastructure and stations [270MT/yr increasing annually to 8,070MT by 2053]		
	Purchase renewable electricity [4,140MT]	
	Rooftop solar [2,160MT]	
	Upgrade lighting & HVAC [1,800MT]	
	Utilize performance contracts [1,260MT]	
	Improve central system efficiency [900MT]	
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	Install heat recovery exhaust [180MT]	
	Water efficient fixtures [unknown]	
	Bottle fillers [unknown]	
	Trayless dining [unknown]	
	High efficiency / electric fleet vehicles and equipment [200MT]	
		Transition to cold weather heat pump [4,680MT]
		Purchase offsets [all remaining emmissions]

Figure 3 Phased Approach to Climate Action Plan Implementation

These measures together can reduce or offset 100% of the emissions by the end of 2053. The top five conservation and offset measures are to 1) transition domestic natural gas hot water to heat pumps, 2) transition campus natural gas heating system to heat pump, 3) purchase renewable electricity, 4) provide renewable electricity for electric vehicles through electric vehicle charging stations, and 5) install rooftop solar arrays.

Next steps

Our analysis shows that it is possible to achieve net zero at Harper College through a phased approach to energy use reduction measures, solar installations and strategic planning. This approach consists of applying a conserve and load strategy, reducing the overall energy use in the facilities, electrification, then satisfying the much more manageable load with renewable energy resources. We recommend tackling easy energy management issues early, while planning to step up to bigger operational and equipment upgrades.

Next steps are for Harper to provide feedback on the climate action plan, to solicit stakeholder feedback, and to finalize the measures to pursue for phase 2 as part of their strategic and capital planning process. Harper should also begin planning to implement more complex, costly, and transformative strategies in phases 3 and 4. Further evaluation of the feasibility of measures will be necessary, considering programs, funding and incentive availability, procurement methods, new policy and operations directions and more. Energy assessments and retro-commissioning will help with Phase 2 implementation goals and Phase 3 planning. One fundamental concept that will aid Harper in their net zero emissions goals is to require any new construction to achieve net zero emissions or be net positive to the campus. Their design should also account for future capital cost avoidance of central plant changes.

Finally, as Harper College begins to implement the measures, we recommend developing plans to track ongoing emissions and monitor progress to ensure that targets are met. This plan should be seen as a living document subject to periodic review and revision as needed.

We thank IGEN for the opportunity to provide net zero planning for Harper and look forward to continuing to assist Harper in their path toward net zero.

2 INTRODUCTION

Climate change presents an immediate threat to our planet's biodiversity and to human life. Scientific consensus is that carbon emissions, which have grown exponentially since the industrial revolution, are the cause of the rise in temperature. Harper College's plan to be net zero emissions by 2053 is an ambitious but achievable means of combatting this global threat. This report by SEDAC shows how Harper College can reach net zero emissions by 2053 and, further, how this ambition is not only feasible but, in fact, the most fiscally responsible path forward. This study and its implementation will be the strongest possible signal the college can send to the campus community of its commitment and leadership towards a sustainable future.

2.1 Emissions Inventory

Information was collected including enrollment data, faculty and staff counts, and utility data. Sources for data multipliers was collected from several sources including the Energy Information Agency, Department of Energy, and the Illinois Commerce Commission to determine unit emissions for various sources of emissions including electricity, natural gas, and gasoline. A comprehensive report was provided in October 2020. For the sake of analysis, we have split the emissions sources of the college down by energy end use. In this report, measures for reduction are considered in 3 major categories, from largest to smallest:

- **Buildings**: emissions from energy use for space conditioning, lighting, plug loads and etc. This category includes purchased electricity and stationary combustion.
- **External transportation**: Includes emissions from commuting by staff, faculty, and students, as well as air travel.
- **Services and Operations**: Emissions from energy use related to the college operations, including mobile combustion (campus fleet) and water/wastewater.

Figure 4 and Table 2 show a breakdown of the emissions by category and scope.

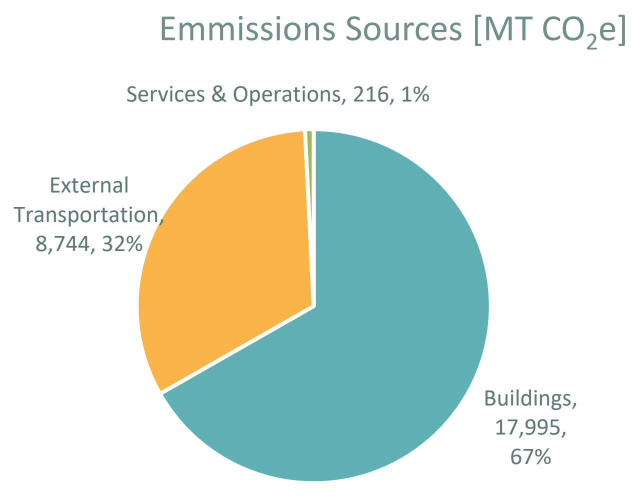

Figure 4. Breakdown of Carbon Emissions by Sector

Table 1: Breakdown of Carbon Emissions by Scope

Emissions category	$MTCO_2e$	% total emissions
Scope 1 Emissions		
Stationary Combustion	8,898.8	
Mobile Combustion	198.5	
Total Scope 1 Emissions	9,097.3	34%
Scope 2 Emissions		
Purchased Electricity	9,474.7	
Purchased Heating	n/a	
Purchased Cooling	n/a	
Purchased Steam	n/a	
Total Scope 2 Emissions	9,474.7	35%
Scope 3 Emissions		
Commuting	8,070.3	
Air Travel	604	
Wastewater	17.3	
Total Scope 3 Emissions	8,691.6	32%
Net 2018-2019 Emissions		
Total ($MTCO_2e$)	26,884.6	
Per Full-Time Enrollment	2.93	
Per 1000 Square Feet	15.78	

2.2 Projection of Future Carbon Emissions

In order to match measures for carbon offsets with expected emissions, we estimate “Business as Usual” (BAU) energy use at the college to 2053. It is anticipated that building growth will continue adding about 1% to building consumption per year. As for commuting emissions, it is anticipated that vehicles will improve their fuel economy by 0.5% per year.

By breaking down the emissions by source, we see the estimated projected emissions over time represented in Figure 5.

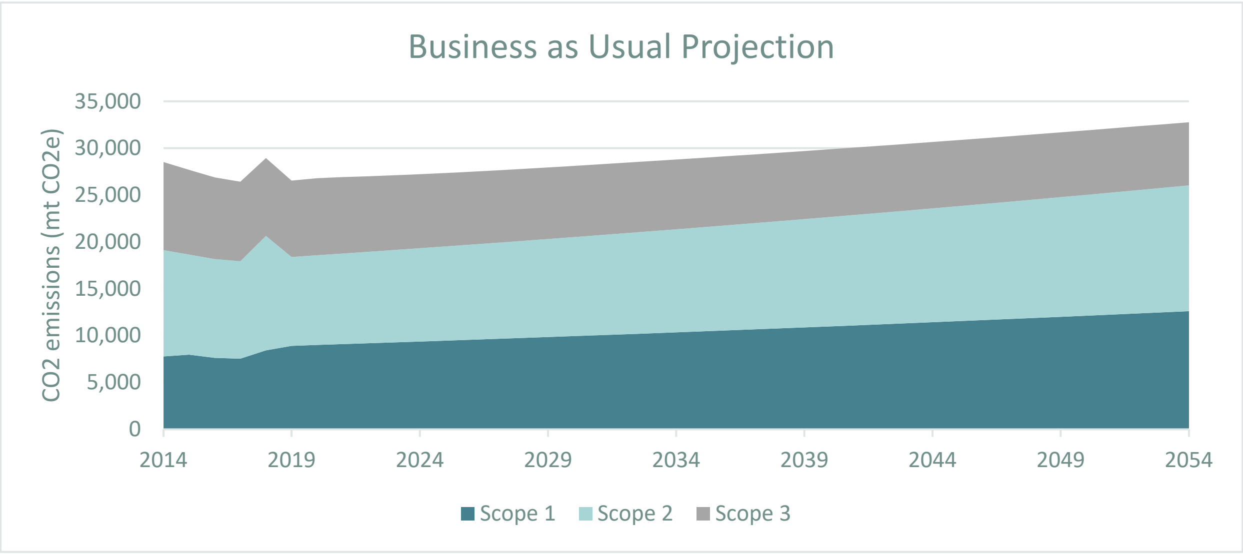

Figure 5 Projection of BAU Carbon Emissions by Source

In order to create an actionable plan for net zero emissions, we need to offset the anticipated emissions above with measures for reduction and generation of electricity. Throughout this report, we will detail these measures. By following the recommended plan, including solar installation, Harper is projected to reach net zero emissions around 2053.

2.3 Reducing emissions: Overall strategy

We employ a ‘conserve and load’ strategy of energy conservation to reduce the overall energy use in the facility, then we satisfy the much more manageable load with renewable energy resources. Total emissions can be reduced by nearly 75%, saving about 20,000 metric tons of carbon annually. The remaining 25% of emissions can be offset with solar installations, purchase of renewable electricity and carbon offsets. Below we describe a phased approach to implementing measures to achieve net zero emissions by 2053. Phase 1 was covered by Harper’s previous climate action plan in 2013.

Phase 2 focuses on low capital cost, easy-to-implement measures (2022-2032).

Phase 3 focuses on moderate capital cost and complexity measures (2033-2042). During phases 2 and 3, we recommend developing rooftop solar arrays of 4,000kW to provide the feasible onsite renewable electricity.

Phase 4 is much longer and focuses on high capital cost and high complexity measures (2043-2053). The proposed measures represent transformational, out-of-the-box thinking and will require Harper College to consider potential new policy directions. We also recommend eliminating natural gas and diesel vehicles and switching to electric vehicles, powered by solar or other renewable electricity during phase 4.

3 PHASE 2 MEASURES: LOW CAPITAL COST MEASURES (2022-2032)

This phase focuses on measures that are relatively low in capital requirements and are implemented first to give Harper time to plan and develop additional capital plans to be prepared for the next phase of implementation.

Measure 1: Retro-commission campus buildings

Potential savings of 2019 emissions: 900 MT CO2e.

It is common for buildings to undergo changes in space use during their lifetime. Building sensors also lose calibration and systems may decrease in effectiveness over time. Retro-commissioning is the process of tuning up the HVAC systems based on present space conditions and available sensors and controls. Much of the savings from retro-commissioning comes from adjusting the HVAC system scheduling to more closely align with current occupancy schedules.

Measure 2: Implement Demand Controlled Ventilation (DCV) control strategies across campus

Potential savings of 2019 emissions: 360 MT CO2e.

Typically, building ventilation rates are designed and set based on the maximum number of occupants a space may contain at any given time. Because of the pandemic, many professionals are recommending increasing ventilation in buildings and measuring ventilation to ensure adequate levels—usually by measuring CO2. A CO2 target of 800 ppm is appropriate to maintain adequate fresh air, keep occupants healthy, and minimize the energy impacts. Given that spaces rarely reach their maximum occupant capacity, many HVAC systems bring in and condition more outdoor air than necessary for good indoor air quality. A DCV system can reduce ventilation when there are fewer occupants, while still ensuring that ventilation rates remain adequate for safety and health.

Measure 3: Reduce exhaust requirements where feasible (quantity or run time)

Potential savings of 2019 emissions: 360 MT CO2e.

Similar to the above Demand Controlled Ventilation, air that is exhausted must have makeup air treated and brought in. SEDAC recommends evaluating the control strategies and operational needs for these fans. There may be spaces that have changed their use and require less exhaust air. It is also important to verify the sealing of exhaust ductwork so that the system isn't exhausting air that is not meant to be exhausted.

Measure 4: Identify opportunities to turn off central heating system during summer

Potential savings of 2019 emissions: 360 MT CO2e.

Harper College operates a steam heating system throughout the year, including during the summer. Frequently, these steam systems have few uses for heat during the summer (e.g., domestic water heating). The system losses remain stable regardless of the load and can even exceed the heat required for campus needs at times. Removing domestic water heating from the steam heating system offers the opportunity to consider technologies such as heat pumps which can extract heat from the building (providing nominal cooling and dehumidification of spaces) and place it into the water. These units can operate at efficiencies of 300% or higher. The other common use of heating in the summer is for air conditioning reheat. The need for this is dramatically reduced or eliminated through the use of variable air systems.

Measure 5: Identify courses that can be offered online or through hybrid methods

Potential savings of 2019 emissions: 260 MT CO2e.

With the COVID-19 pandemic, many college operations were forced online. This experience provided an opportunity for Harper College to learn what activities can effectively move to remote participation without detrimental impact. Once the pandemic is over, the College may decide that some online or hybrid activities should continue. This will reduce the need or frequency of commuting to campus.

Measure 6: Encourage the use of carpools or vanpools

Potential savings of 2019 emissions: 90 MT CO2e.

Carpooling can reduce commuting emissions by 50-80%. Common methods for encouraging carpools include the use of preferential reserved parking spaces closer to buildings or by offering another incentive. It can be difficult to encourage carpooling as many people don't want to give up the flexibility and convenience of single occupancy vehicles. One way to address participants' desire for flexibility and convenience is by offering hourly vehicle rentals (e.g., ZipCar) for people who need to travel at times outside of their carpool.

Measure 7: Utilize low carbon travel where feasible

Potential savings of 2019 emissions: 90 MT CO2e.

Air travel is very carbon intense compared to travel by car, train, bus, or bike. Colleges can limit air travel to locations that are a significant distance away (> 300 miles) to justify the cost and emissions impact. They can also encourage bike sharing and bike coops to encourage people to bike rather than use their cars.

Measure 8: Minimize travel where possible

Potential savings of 2019 emissions: 90 MT CO2e.

Minimizing staff, faculty, and student travel can also help reduce emissions. Because of the pandemic, many of us have learned that it is possible to participate in conferences, meetings, and activities remotely. Reducing this travel enables students and staff to be more efficient with their time. Because air travel has a substantially higher carbon footprint than other modes of transportation, the college should work to minimize air travel and use other low-carbon transportation methods instead.

Measure 9: Use low-maintenance landscape practices with native plantings

Potential savings of 2019 emissions: 4 MT CO2e.

Much of Harper's campus is turf grass. Turf grass commonly requires fertilizer, mowing, and watering. It is a monoculture which can lead to easy transmission of disease and pests. Native and xeriscaping is a more natural landscaping approach and can be appropriate for many of Harper's grounds. Native plants are typically more drought tolerant and able to absorb more rain than most turf grasses, which can help reduce storm water runoff. Native plantings can filter stormwater, removing pollutants from the stream.

Measure 10: Right size vehicle fleet

Potential savings of 2019 emissions: 4 MT CO2e.

Vehicles are often selected for special scenarios, rather than everyday operations. For instance, an organization might purchase a full-size pick-up truck for the rare times when there is a need to haul large items. Smaller vehicles have the advantage of being more efficient, more maneuverable and less likely to be involved in accidents.

Measure 11: Encourage use of electronic document transmission and submission

Potential savings of 2019 emissions: unquantified

Electronic documentation transmission has become more prevalent and is replacing paper document transmission. Multi-function printers have scan-to-email functionality which provides an easy method to convert physical documents into digital. These digital services can reduce the emissions associated with campus mail services and paper purchasing.

Measure 12: Promote transition to electric vehicles for students and staff (Phases 2-4)

Potential savings of 2019 emissions: 270 MT CO2e.

We recommend implementing this measure over phases 2-4, as the shift towards electric vehicles is expected to slowly continue over the next 30 years. Encouraging students and staff to move to higher efficiency vehicles such as hybrids or electric vehicles is an important way to reduce transportation emissions. The College could offer an incentive to help staff move to higher efficiency vehicles. The payment could be determined by the miles per gallon improvement from the baseline (for instance $25 per mpg improvement). A person who drives a truck that gets 20 mpg and trades in for a car that gets 30 mpg would be eligible for a $250 incentive. A similar program could be used for switching to electric with a fixed incentive such as $500 for the switch.

This transition is likely to require several years due to substantial infrastructure required to provide enough vehicle charging stations. Harper will need charging infrastructure to support its own electric vehicles and the electric vehicles of students and employees, thus encouraging and facilitating the transition to broader vehicle electrification. Electric vehicle charging will impact the college's load profile, depending on how it's managed and may require infrastructure upgrades. Emerging vehicle-to-grid technologies at scale take advantage of stored electricity in the batteries and offer a variety of grid services (demand flexibility, voltage and frequency regulation) that utilities pay for. Vehicle charging stations may provide a revenue model that makes the investment financially attractive.

Harper may choose to pass along the full cost of charging to students and staff or may decide to partially or fully subsidize charging to accelerate adoption of electric vehicles.

4 PHASE 3 MEASURES: MODERATE CAPITAL COST MEASURES (2033-2042)

This phase includes items that require more capital investment. This phase also includes development of rooftop solar arrays of around 4,000 kW to provide onsite renewable electricity.

Measure 13: Purchase renewable electricity

Potential savings of 2019 emissions: 4,140 MT CO2e.

Purchasing renewable electricity is likely one of the easiest and most impactful measures on Harper's path to achieving net zero emissions. The college already purchases electricity through the current deregulated market. Harper currently specifies a portion of their electricity must be renewable. For future contracts, this could be increased to 100%.

Measure 14: Install solar PV systems on college rooftops

Potential savings of 2019 emissions: 2,160 MT CO2e.

To demonstrate Harper's commitment to renewables and reduce emissions from transmission of electricity, Harper could pursue installation of solar or other renewables on their campus, particularly on roofs. The preferred method for most solar procurement is through a power purchase agreement. This would be similar to other electricity procurement where Harper pays a set price per kWh produced by the arrays over a fixed time period. The developer is responsible for the installation and maintenance of the solar systems.

Net metering is the agreement that enables utility companies to credit producers of power for the electricity they generate. Net metering agreements determine how much power the utility company will “buy back” from the consumer at the same rate at which power is purchased from the utility company. ComEd has a fairly generous net metering policy enabling net metering for arrays up to 2,000 KW. Harper would likely exceed this through rooftop solar. However, given the campus’ size, the impact may not be substantial as nearly all of the electricity would be consumed by the campus and not exported to the grid, particularly with the added load of vehicle electrification.

Measure 15: Upgrade lighting and HVAC systems across campus

Potential savings of 2019 emissions: 1,800 MT CO2e.

Upgrading lighting to LED reduces energy consumption and heat generation which may enable Harper to downsize HVAC systems. Lighting systems continue to improve in efficiency and longevity. Moving from florescent fixtures and discharge lighting to LEDs can cut lighting energy consumption by 75% or more. Additionally, several new products allow Harper to select the color temperature and the intensity and change it over the life of the product. This may be useful for spaces that may change use over time. Past lighting designs have consumed 1-2 watts per square foot. LED designs now use under 0.5 watts per square foot. This dramatic reduction in energy consumption can enable downsizing of HVAC systems.

Additionally, constant volume HVAC systems which were common in the past consume substantially more energy than variable volume control methods. Variable volume HVAC systems can reduce energy consumed when spaces are occupied to their design limits. Additionally, they may allow reheat use to be minimized or discontinued during the cooling season.

Older HVAC systems operate on a central schedule which starts the central air handlers, sets VAV zones to minimum positions and maintains temperature setpoints. Some older systems use occupant sensing devices to turn the zone on only when occupants are sensed. This approach does not provide the system with information about how many occupants are in a space to provide appropriate airflow and ventilation. In addition, temperature sensing only provides information for heating and cooling, and does not address ventilation. Adding CO2 monitoring allows the system to activate and adjust operations based on occupancy.

Harper should look to upgrade HVAC system controls to include zone CO2 controls and variable air systems wherever possible.

Measure 16: Utilize performance contracting for large scale improvements

Potential savings of 2019 emissions: 1,260 MT CO2e.

Performance contracting provides improvements that reduce energy consumption and use the reduction of the energy costs to pay for those improvements. These contracts need to be used with care like any tool. Given the potential for savings over a 20 year period and the potential scale of a performance contract, care needs to be exercised to prevent issues from poor/weak measurement and verification protocols that may not fully realize savings.

Performance contracts typically include a combination of projects with short paybacks and high returns on investment (e.g., lighting and motor improvements) as well as projects with longer paybacks and lower returns on investment, such as new central plants or major system replacements.

Measure 17: Improve central plant efficiency

Potential savings of 2019 emissions: 900 MT CO2e.

The central chillers and boilers need to be cleaned, adjusted, and tuned periodically to maintain their efficiency. This may also include adding insulation (at or beyond the IECC code requirement) to the central plant piping to reduce system losses. Harper should calculate the optimum levels of insulation based on the costs of insulation and utilities. Insulation tends to have a long useful life, particularly on piping. For valves and other parts that require periodic service, consider using removable insulation, such as insulation attached with Velcro that can be quickly removed and reinstalled.

Measure 18: Improve envelope air tightness

Potential savings of 2019 emissions: 360 MT CO2e.

Air infiltration has a substantial impact on comfort and energy consumption. Improving the air tightness of the envelope also improves the control of the environment and reduces the transfer of humidity and pollutants between the outside and inside of the building. This may include weatherstripping, caulking, or sealing around fenestration or electrical outlets.

Measure 19: Install heat recovery exhaust/makeup systems

Potential savings of 2019 emissions: 180 MT CO2e.

Anytime air is removed from a building, an equal amount of air must be brought into the building. For locations where the exhaust and makeup air are in close proximity, it’s relatively easy to recover the energy from the air stream. Avoid relying on air handlers and envelope leaks to provide makeup air. Instead, use a heat recovery ventilation or energy recovery ventilation device. A bathroom, for instances, typically just uses an exhaust fan and pulls makeup air from the building causing the building to leak. A preferable alternative would be to use an energy recovery ventilator to remove the air from the room and introduce the fresh air either just outside the bathroom or just inside if the door does not have adequate airflow through it.

Measure 20: Install water efficient fixtures

Potential savings of 2019 emissions: unquantified.

Efficiency in water fixtures has dramatically improved over the last few decades. Newer toilets, for example, consume 1.6 or 3 gallons per flush, compared to older models that consume 5 gallons per flush. Some of these initial efficient designs had lower performance, but there are many designs that still can achieve a top MAximum Performance (MAP) rating of 1,000. Similar improvements have been made for urinals and faucet aerators.

Measure 21: Install bottle filling stations

Potential savings of 2019 emissions: unquantified.

This measure provides access to bottle filling stations to enable occupants to refill bottles or cups. Many of these can be retrofitted to existing drinking fountains to reduce the difficulty of installation (e.g., running additional supply and drain lines).

Measure 22: Move to trayless dining options

Potential savings of 2019 emissions: unquantified.

Campus dining services often use trays, but this encourages people to take more than they may consume, leading to food waste. Eliminating trays can substantially reduce food waste and emissions associated with dishwashing.

Measure 23: Move toward higher efficiency and electric maintenance vehicles and equipment (Phases 3 & 4)

Potential savings of 2019 emissions: 200 MT CO2e.

Vehicle or equipment replacement is an opportunity to replace with more energy efficient or electric versions. Electrification of vehicles and equipment will enable renewable energy to be used to achieve net zero emissions. Electric and battery electric tools (such as batwing mowers) have dramatically improved in recent years. This can be done as vehicles and equipment are replaced.

5 PHASE 4 MEASURES: HIGH CAPITAL COST MEASURES (2043-2053)

This phase requires substantial capital cost and includes replacing the natural gas central heating system with an electric heat pump. This could be done through either ground source heat pump or low temperature air source heat pumps. Improving the levels of insulation and performance of equipment will have a substantial impact on the capital required for this phase. Commonly, measures are evaluated based on the energy savings and fail to account for capital savings from smaller HVAC and central plant requirements.

Measure 24: Transition central heating system to either geothermal or cold weather air source heat pumps

Potential savings of 2019 emissions: 4,680 MT CO2e.

This next to last measure includes a transition from central heating boilers to heat pumps. One potentially creative solution would be designing for lower temperature heating supply temperatures. Commonly in the US, water supply temperatures of 180F is used. Using 140F or lower supply temperatures enables use of technologies such as dedicated heat recovery chillers which can provide heating and cooling with a single process for times when there is a need for both heating and cooling at the same time. We recommend pursuing this measure after loads have been reduced to lower the cost of replacement.

Measure 25: Purchase carbon offsets

Potential savings of 2019 emissions: all remaining emissions

To offset any remaining emissions and achieve net zero, we recommend that Harper consider purchasing certified carbon offsets that are 3rd party verified. Purchasing carbon offsets is often perceived as less desirable than other measures because the carbon offsets (e.g., planting trees in a developing country) do not offset the emissions to which they are linked. Organizations that pursue carbon offsets often do so without taking meaningful action to reduce their own carbon emissions. Carbon offsets also represent an annual cost for the organization and will take money away from other programs. We recommend purchasing carbon offsets only after Harper has addressed all other conservation and on-site renewable energy generation measures.

6 FINAL PROJECTED INVENTORY OF EMISSIONS

This plan shows that realization of net zero emissions by 2053 is both challenging and possible for Harper College. We recommend starting a gradual reduction of the current emissions with the "Conserve and Load" approach.

Phase 2 (2022-2032) features easier-to-accomplish and less disruptive measures. The initial phase focuses on near term improvements such as retrocommissioning buildings across the campus, enabling students to attend classes remotely where practical and effective, reducing the land area that requires frequent maintenance, and enabling the central heating system to shut down during the summer months. It is also anticipated that during this phase Harper will begin installation of infrastructure to support electric vehicle charging as the overall cost and duration of providing enough infrastructure will be a multi-decade project to fully implement.

Phase 3 (2033-2042) begins the more aggressive and transformative actions needed to move towards net zero. Phase 3 is characterized by the adoption of larger capital expenditures such as rooftop solar, upgrading the lighting and HVAC systems across campus, improving envelope air tightness, and installing heat recovery on exhaust systems. Electrifying Harper's vehicle fleet would also be done during phases 2 and 3.

Phase 4 (2043-2053) is characterized by more fundamental changes to the campus including eliminating the use of natural gas and moving to either cold weather air source heat pumps or ground source heat pumps. This would also be the phase where Harper would purchase offsets for any remaining emissions that they were not able to reduce.

Figure 6 below summarizes the proposed phased approach for implementation of the measures to achieve net zero. Figure 7 shows the quantitative impact of the recommended measures over time, and their respective contributions towards the push towards net zero.

Harper College can begin Phase 2 implementation planning now and initial planning for many of the recommended Phase 2 measures. We commend Harper College for past and ongoing efforts in pursing net zero and its continued interest in planning and implementing the measures to achieve net zero by 2053.

6.1 Summary and Recommended Action Plan

Phase 2: 2022-2032 [CO_2 Reductions]	Phase 3: 2033-2042	Phase 4: 2043-2053
Retrocommission buildings [900MT]		
Implement DCV [360MT]		
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Right Size fleet [4MT]		
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Install electric vehicle charging infrastructure and stations [270MT/yr increasing annually to 8,070MT by 2053]		
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	Trayless dining [unknown]	
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		Transition to cold weather heat pump [4,680MT]
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Figure 6 Recommended Action Plan

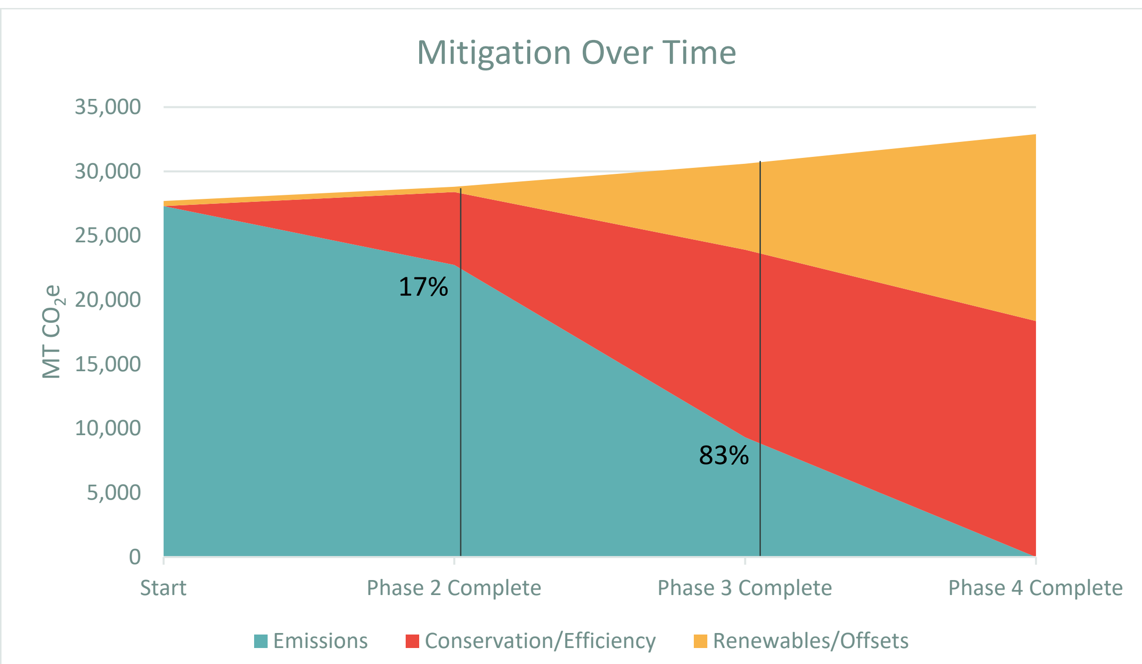

Figure 7 Mitigation Impact Wedges