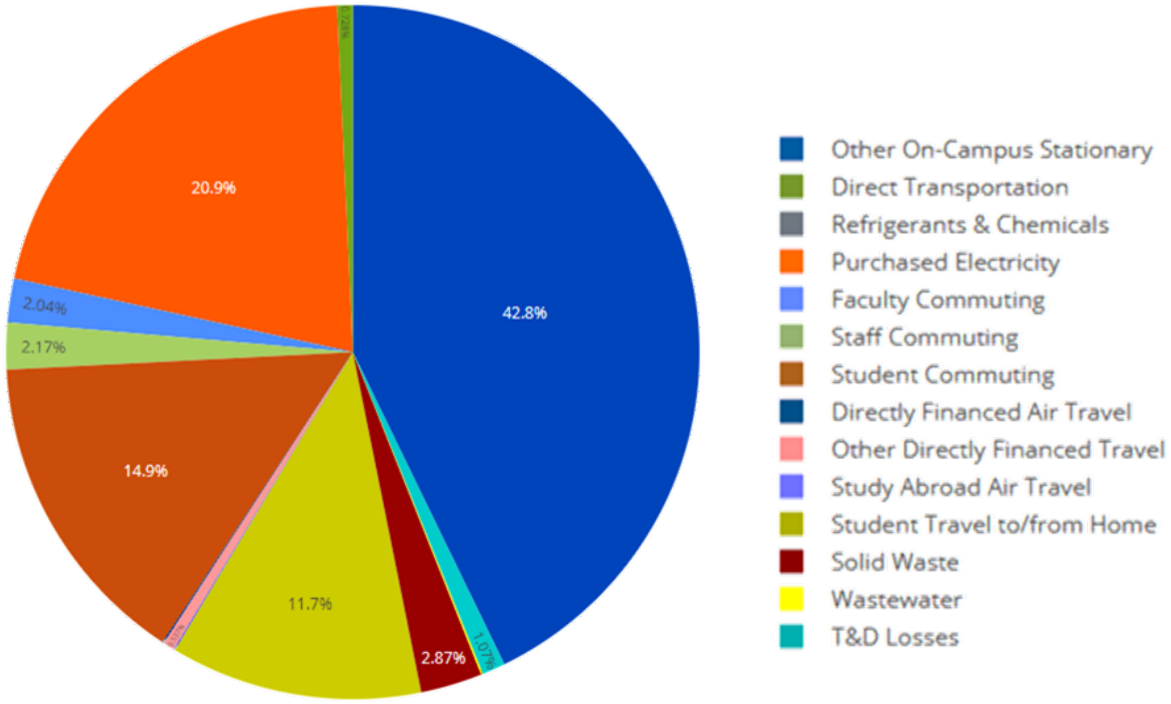
Executive summary

In the Fall of 2021, the UW-Eau Claire campus carbon footprint was measured by the Honors Colloquium course, Taking the Measure of Sustainability. This marks the fourth time this class has completed this annual assessment and the eighth time that the Honors program has contributed to campus climate and sustainability commitments since 2010. (Before this, the initial biennial 2008 carbon footprint analysis was performed as an IDIS course.) The original reason this process began was as part of the reporting requirements of the American Colleges and Universities Presidents' Climate Commitment (ACUPCC), which the University joined as an inaugural signatory in 2007 under the leadership of former Chancellor Brian Levin-Stankevich. It is intended to support the campus commitment to achieve net carbon neutrality, as established in 2018 with the passage of the campus Climate Action Plan ratified by the Chancellor Jim Schmidt and all campus governance bodies in 2018.

Since then, the analysis has continually evolved and advanced, improving the analysis as better sources of data become available, tweaking the techniques, and incorporating additional emission sources as the analysis expands and as the campus has expanded. As they were built over the past four years, we have begun to include University-leased housing units, The Priory, Haymarket Landing, Aspenson-Mogenson, and the shared facility, Pablo Center for the Arts. Last year, we began incorporating emissions from UW-Eau Claire Barron County into the analysis; this year we expanded this to be more inclusive of all emission sources currently analyzed for the Eau Claire campus. Attempts have been made to include the Marshfield Nursing campus emissions, but this has been unsuccessful because the of the shared nature of that facility. Other innovations include an updated and streamlined campus commuting and transportation survey and an evaluation of the emissions generated by student travel to and from their permanent residence. We also discontinued the analysis of food service emissions because of data from Sodexo were not made available as in the two previous years; instead, we made a first attempt at incorporating "upstream" emissions from University purchases utilizing a Spike Cavell Analytics report.

This year's analysis quantified emissions from July 1, 2020 through June 30, 2021 (with a few exceptions noted below). One unusual characteristic of this greenhouse gas emissions inventory is that this was the second year that our emissions were substantially curtailed by changes in campus practices necessitated by the covid-19 pandemic. However, this affected the full year rather than just one semester as for the previous year, so it was made easier because the same assumptions and analysis techniques could be applied to the full year rather than two completely different semesters. The final difference for this analysis in this year's inventory is the collaboration with the new office for Safety, Risk Management, and Sustainability, directed by Brian Drollinger. He and the two graduate interns in this office, Easton McCready and Cassidy Hempel, contributed to the initial data collection process. We hope to build on this relationship in future years.

The Overview section below graphically summarizes the work done by six separate groups of students from HNRS 389. It should provide enough information for those wishing to gain a broad overview of the relative contributions of campus emissions, an idea of long-term trends, the effects of emissions reductions due to the covid response, and of including newly analyzed emission sources. Subsequent pages provide a more in-depth understanding of any emissions source: the context of the measurements, a more detailed look at the quantitative results, the process to obtain them, and a discussion of their significance. These sections are excerpted directly from student term reports with minimal editing.

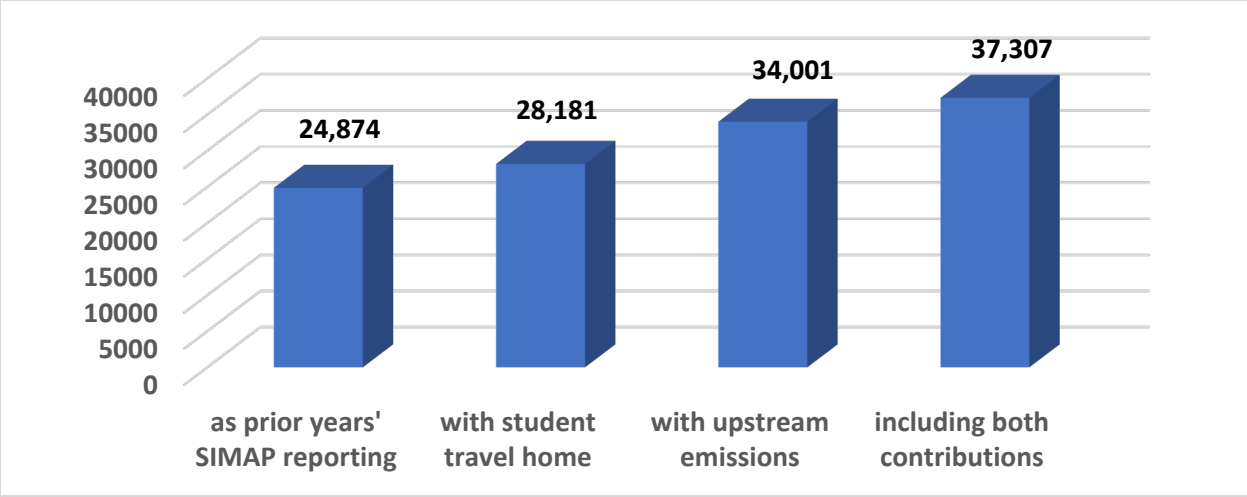


2021 total campus emissions in GHG MTCDE: ~28,000 MT CO2e

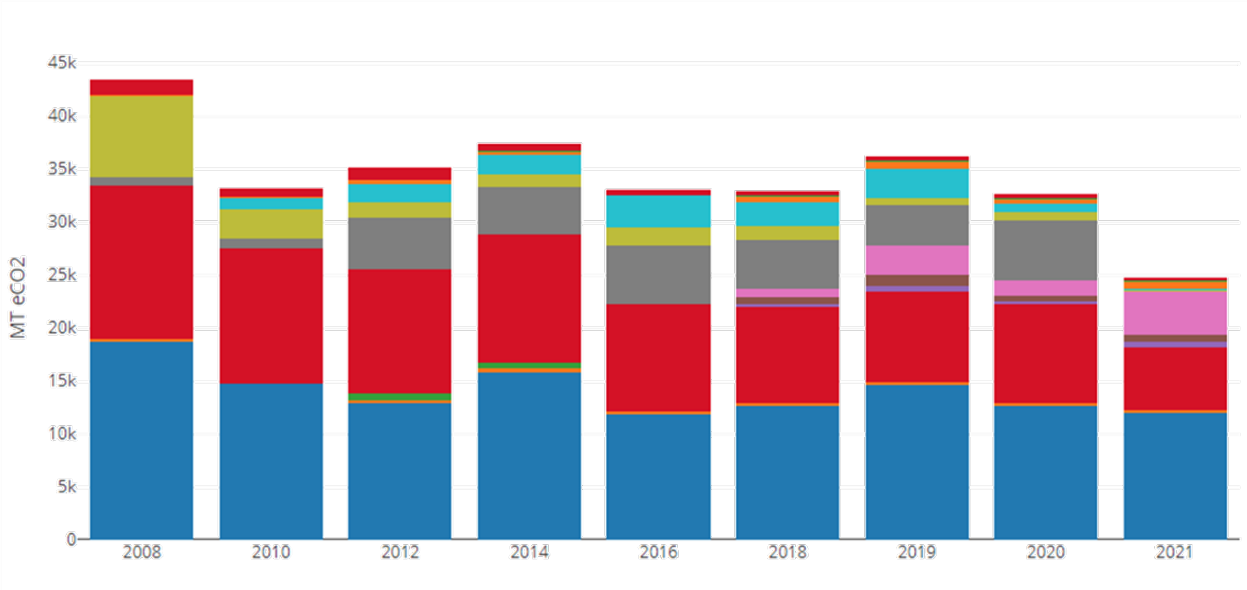
Carbon

Fiscal Year	Scope	Source	CO2 (kg)	CO2 (MTCDE)	CH4 (kg)	CH4 (MTCDE)	N2O (kg)	N2O (MTCDE)	GHG MTCDE
2021	1	Other On-Campus Stationary	12,021,250	12,021.25	1,219	34.14	27	7.22	12,062.60
2021	1	Direct Transportation	203,628	203.63	7	0.20	5	1.24	205.07
2021	2	Purchased Electricity	5,841,811	5,841.81	627	17.57	73	19.29	5,878.67
2021	3	Faculty Commuting	570,411	570.41	30	0.85	19	5.01	576.26
2021	3	Staff Commuting	605,931	605.93	32	0.90	20	5.34	612.17
2021	3	Student Commuting	4,178,068	4,178.07	171	4.79	108	28.64	4,211.50
2021	3	Directly Financed Air Travel	21,017	21.02	0	0.01	0	0.06	21.09
2021	3	Other Directly Financed Travel	131,872	131.87	131	3.67	60	15.78	151.32
2021	3	Study Abroad Air Travel	20,128	20.13	0	0.01	0	0.06	20.19
2021	3	Student Travel to/from Home	3,273,282	3,273.28	172	4.81	108	28.52	3,306.61
2021	3	Solid Waste	0	0.00	28,905	809.34	0	0.00	809.34
2021	3	Wastewater	0	0.00	124	3.47	79	20.84	24.31
2021	3	T&D Losses	299,833	299.83	32	0.90	4	0.99	301.73

Tabular data comprising pie chart above; includes student travel to home, but not additional scope 3 emissions. These are from SIMAP, for reporting as part of ACUPCC requirements.

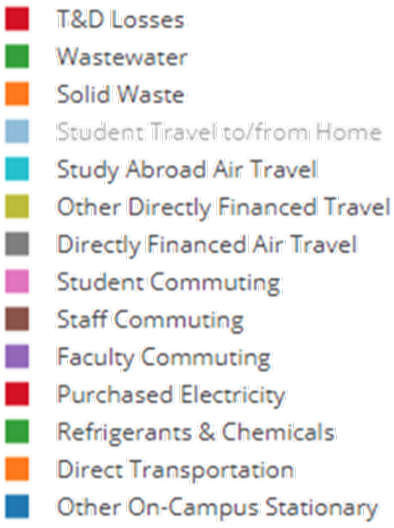


Comparison of prior years' reporting practices with addition of newly included emission sources: student travel home and additional scope 3 emissions from Spikes Cavell Analytics report.

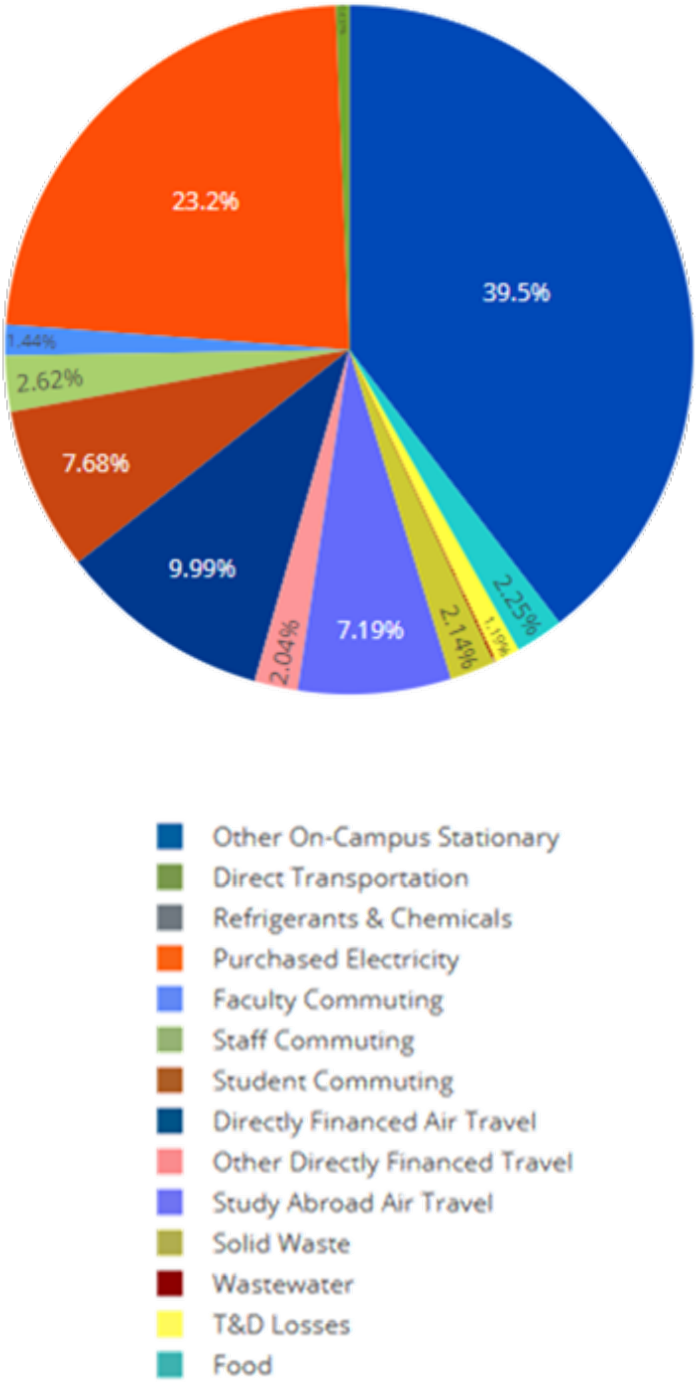


Baseline analysis over 13 years of campus carbon footprint; note that 2021 totals do NOT include student travel home, food services, OR additional scope emissions for continuity.

2021 total campus emissions in GHG MTCDE: 25,000 MT CO2e



To compare to “normal” year, here are the 2019 total campus emissions in GHG MTCDE: ~36,000 MT CO2e



Contents

Heating, cooling, and electricity emissions

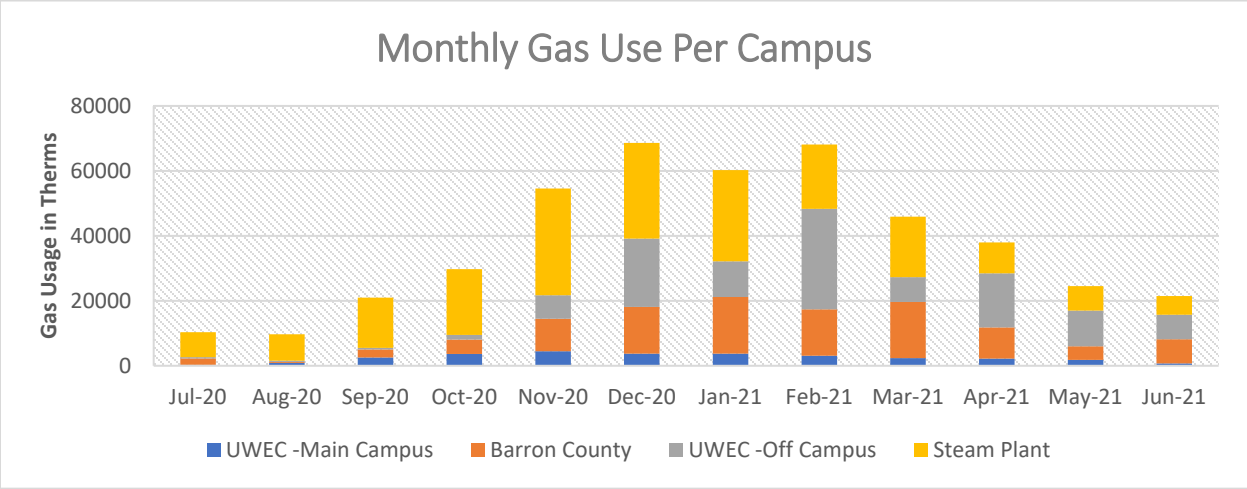
Introduction

Heat and electricity data specifically pertains to the gas and electricity usage of each University owned or leased building, omitting the Marshfield campus. This includes all the residence halls, both on and off campus, all lower campus buildings, Bollinger Fields, the steam plant, and the entire Barron County campus. Our analyzed emissions pertain to Scope 1 and Scope 2. Scope 1 emissions being those emissions that are directly produced by the University. The Scope 1 emissions are entirely comprised by the steam plant. Scope 2 emissions consist of indirect emissions which come from the purchase of electricity. All electricity data in this analysis falls into Scope 2.

Data excluded from this summary includes Aspenson-Mogenson electricity and gas for the whole fiscal year, Priory gas data from July 2020 to October 2020. The Pablo Center is also missing 6 months of data for both electricity and gas spanning from July 2020 to November 2020, and January 2021. In addition to these missing 6 month, there is additional month of gas data for the Pablo Center missing in March of 2021. It is worth noting that UWEC is only responsible for 33% of the Pablo Center emissions, thus the given data was multiplied by 1/3. Barron County was missing 3 months of electricity data, spanning from June 2020 to September 2020.

Main Campus Scope 1

Scope 1 emissions were entirely made up by the steam plant in units of MMBTU. This was the first year that the steam plant had operated entirely coal free, running exclusively on majority natural gas and a small portion of distillate oil, making this last year the cleanest operating year in university steam plant history as far as fuel mix is concerned.

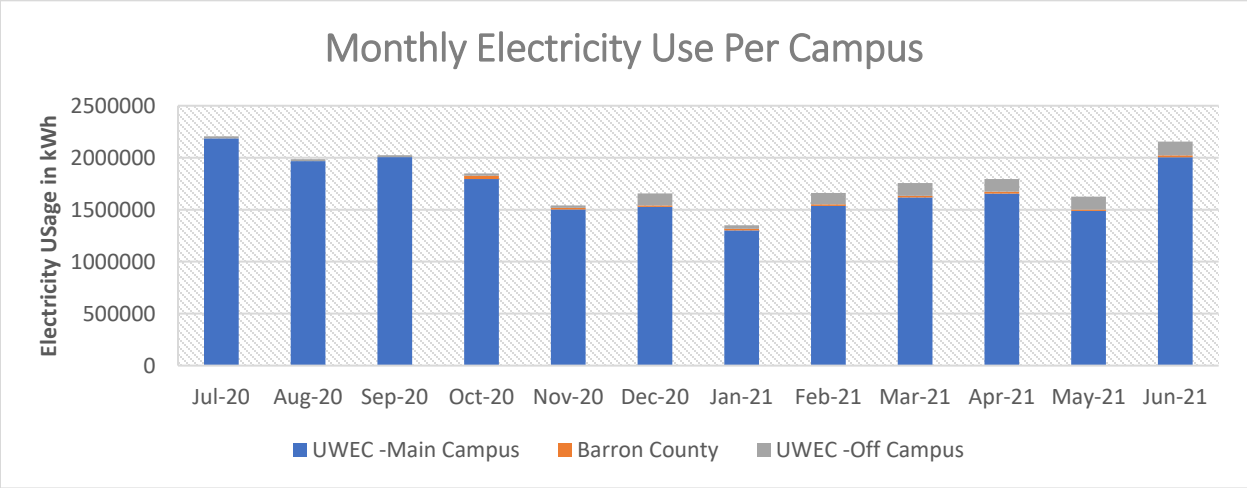


This year, 218132 MMBTU of natural gas was burned at the steam plant, along with 47224 gallons of distillate oil. This resulted in an accumulated 12021.25 metric tons of CO_2e. Comparing this to the previous year's steam plant emissions totaling 11531 metric tons of CO_2e, we do see a minor increase in emissions. This is most likely due to COVID-19 in the 2019-2020 spring semester cutting much of the need for intensive heating due to the lack of students on campus. This relatively slight increase in emissions is most definitely a positive sign regarding the cleaner fuel mix, having operated for the whole 2020-2021 fiscal year, but only producing about ~500 more tons of CO_2e.

Thus, the absence of coal being burned at the steam plant is already manifesting itself in lower average emissions.

Main Campus Scope 2

As expected, the main contributor to the main campus electricity usage is upper campus, which includes all the residence halls, Hilltop Center, McPhee, and the Crest Center. This comes as no surprise due to the residence halls being in high use for most of the year, with drops in electricity use during winter break. There is an increase in electricity use during the summer months on upper campus, even with a lack of students, but this is most likely due to the increased need for cooling during the summer.



Emissions Summary

Total Steam Plant Gas Usage (converted from MMBTU): 2031467.55 therms

Total Main Campus Electricity usage: 20585845 kWh

Total Main Campus Gas Usage: 29616 therms

Total Main Campus Emissions: 16,981.58 MT of CO2e

Total Barron County Electricity Usage (from provided data): 205000 kWh

Total Barron County Gas Usage: 106229.31 therms

Total Barron County Campus Emissions (from provided data): 657.62 MT of CO2e

Total Off-Campus Electricity Usage (from provided data): 1239060 kWh

Total Off-Campus Gas Usage (from provided data): 151266.33 therms

Total Off-Campus Emissions (from provided data): 567.08 MT of CO2e

Discussion

The heat and electricity data from the data above represents the largest portion of the total campus emissions. Thus, as an academic institution, it becomes worth analyzing how much of the total energy and carbon emissions every student embodies on the Eau Claire campuses from heat and electricity alone, since the sector is one in which the students passively partake in simply by attending the University.

UW- Eau Claire's Steam Plant - Spectator

The steam plant is the largest contributor to campus emissions by far, producing roughly 12015.25 MT of CO_2e in the last fiscal year. Large amounts of CO_2e in the atmosphere act as a heat sponge, capturing solar light radiation and distributing it amongst other molecules in the air, thus warming the atmosphere. The steam plant serves as a direct and significant cause of this effect from our campus.

Heat and electricity are both emitters that we live with passively without much thought. When you enter a building, the temperature is comfortable, the lights are on, and you're ready to do work. This is seen as such a standard that the average individual thinks very little of how those daily facts of life effect the environment, however; heat and electricity are non-negotiables. We need both to provide a comfortable learning environment for the attending students. Thus, the argument becomes one of efficiency rather than omission. By implementing an effective "culture of sustainability" on campus, and expecting a sustainable standard for the universities future, we can effectively help negate many future potential emissions. With the new Sonnentag building and Science building on the way, there is an opportunity to make the next two buildings joining campus the most sustainable ones we have.

UW- Eau Claire New Science Building- uwec.edu

The new Sonnentag Center - Kahler Slater

Waste and wastewater emissions

Introduction

The goal of the campus carbon footprint activity was to measure how the different elements that keep the campus running contribute to the amount of CO2e that the campus emits. More specifically, we focused on solid waste, water waste, and refrigerant leaks. Between these three categories, they cover scopes one and three emissions. The refrigerant leaks are considered scope one and both the waste and water waste are scope three. The areas that we focused on were the main University of Wisconsin Eau-Claire campus, the Barron County campus, UWEC's outlying leased buildings, which include Aspenson Mogensen, Haymarket, and The Pablo Center, and the Priory Residence Hall.

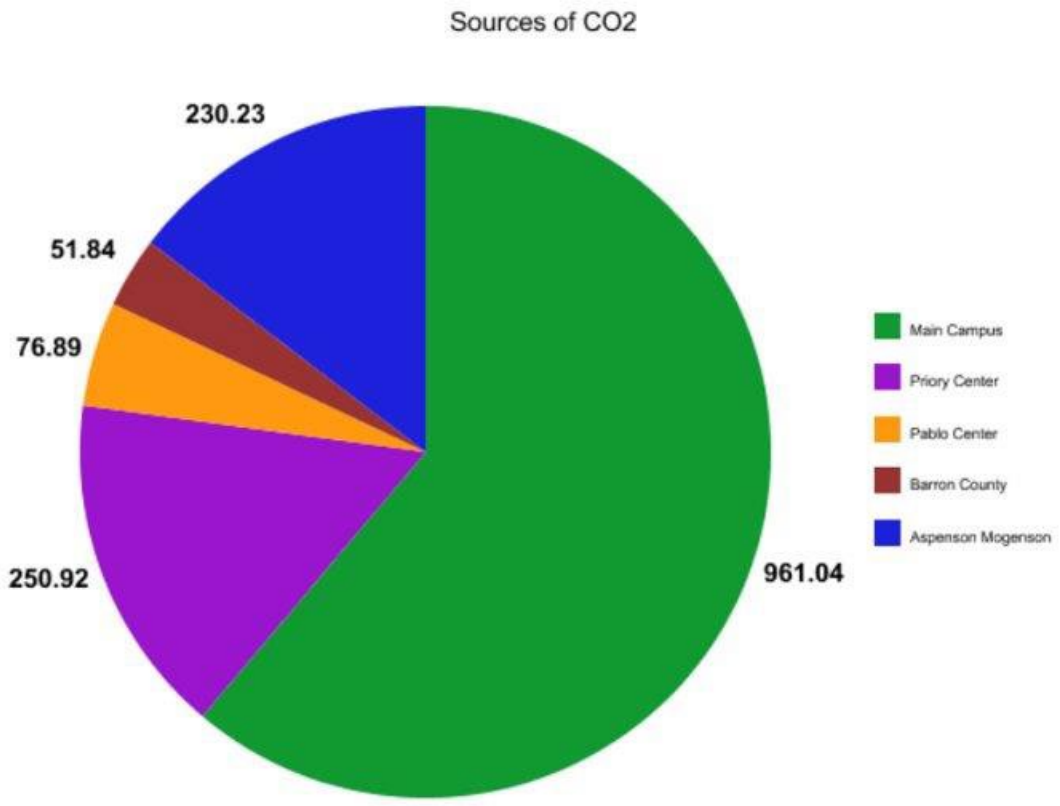
Some of the sources lacked information: for example, the one for the Priory only had the month of September. In order to account for this, we just multiplied those tons of waste by 9 because it is a dorm, and so it is occupied for 9 months out of the year. The data for Aspenson Mogensen and the Pablo Center was an 11-month period but in 2021. We decided that this data was sufficient for the year we were measuring since the months this year compared to last year would be similar and it is better than excluding the data. The final limitation for solid waste was the fact that there was no data for Haymarket. We think this is a significant issue because the Aspenson Mogensen dorm was a significant amount of waste and Haymarket is very similar as far as its functions go. There were also some limitations for the wastewater: there was no data provided for Aspenson Mogensen and there was also data missing for the Barron County campus wastewater for April, May, and June of 2021. In its place, data from the previous year was used.

Refrigerant fugitive emissions

There were no refrigerant leaks. This is very good because the refrigerant emissions are an incredibly significant contributor to CO2e if there are any.

Solid waste

The graph below is in units of tons for all the relevant sources that we measured for solid waste. As you can see, Haymarket is not part of this graph since there was no data provided from them. The UWEC main campus has the largest part of the pie graph which can be expected due to the number of people who use its facilities. The priory center was surprisingly higher than Aspenson Mogensen. We believed this could be attributed to the fact that it is also a day care center, so the waste is not just coming from the students living there. Pablo center being relatively low made sense since it is not constantly occupied and mostly used for events on weekends. Barron county campus only has one dorm and most student's commute so the low level of waste for that part of campus also makes sense.



All solid waste was calculated as “Solid Waste: Landfilled Waste CH4 Recovery and Flaring”. There are 28,905 kg of methane emissions. Methane has more than 80 times the warming power than CO2; therefore, the recovery and flaring exists. It takes the methane and burns it so that it becomes CO2 instead which is a less significant greenhouse gas. The emissions totaled 809.34 metric tons of CO2 equivalent.

Wastewater

This is significantly larger than wastewater emissions. There are three different calculations for the total greenhouse gases that were produced by the wastewater treatment. These are aerobic treatment, anaerobic treatment, and anaerobic digestion. They each produce various levels of greenhouse gases due to the differences in the treatments. The main gases that were produced were CH4 and N2O. The total amount of CH4 produced through the wastewater treatment was 124 Kg, and the total amount of N2O produced was 79 Kg. These were then converted into CO2e. The total emissions produced by the wastewater treatment was 24.3 MTCDE.

Although our scope was only a sliver compared to other sources, it is vital to reduce all emissions of CO2e.

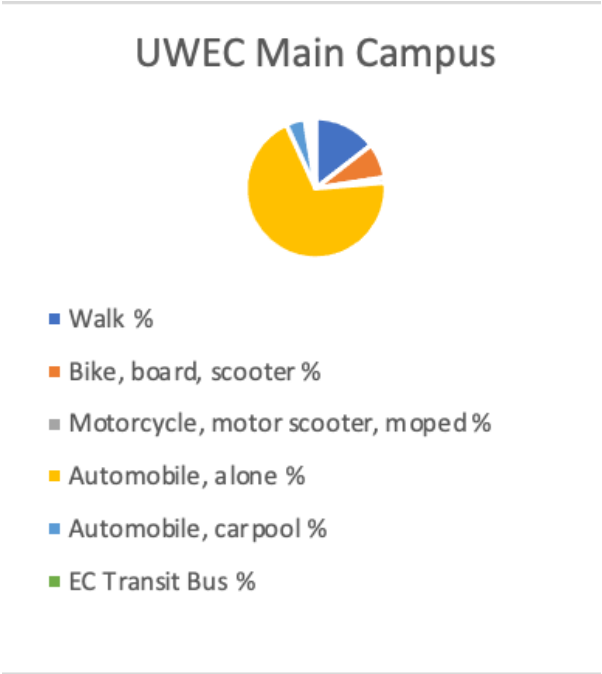
Commuting emissions

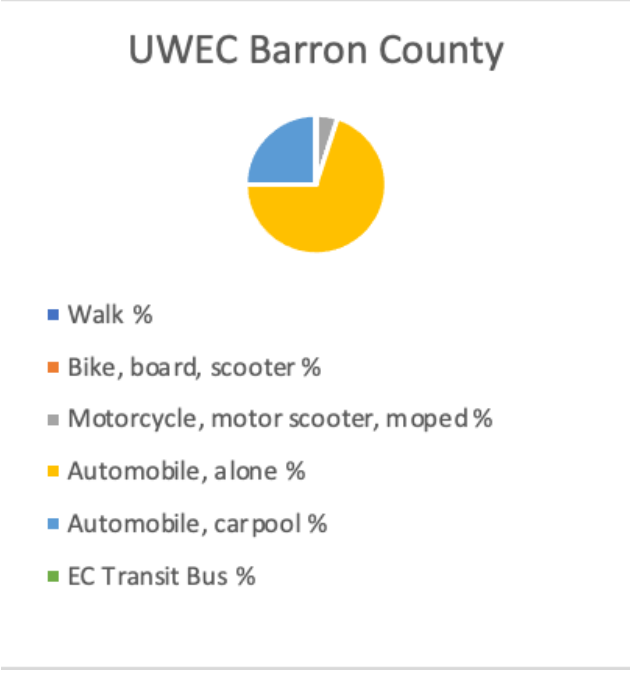
Introduction

Emissions captured by the campus commuting survey are within scope 3. This includes all transportation to and from campus, as well as university-related transportation. The time period used for the analysis was the previous year for everyone except freshman. The freshman completed the survey for the current year. We received all data from the respondents of the survey. We were able to divide up the amount of data in groups of students, faculty, and staff (academic and non-academic). Before sending out the survey, we tested and edited the survey three times to make sure that the survey had clearly stated questions and was easy to use. When sending out the survey, we used an incentive to complete the survey (gift cards). We received 1,670 respondents at the end of the survey. We recognize the limits of self-reporting via survey because of the many factors that can influence the reliability of the date received.

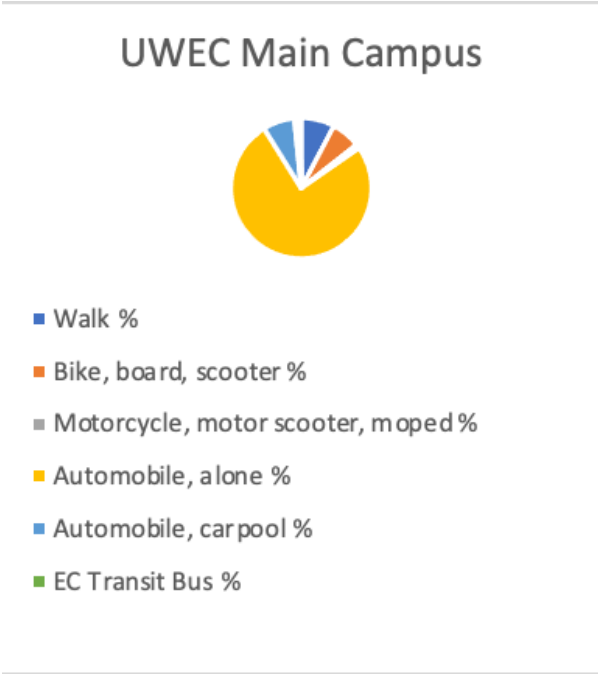
Faculty and Staff

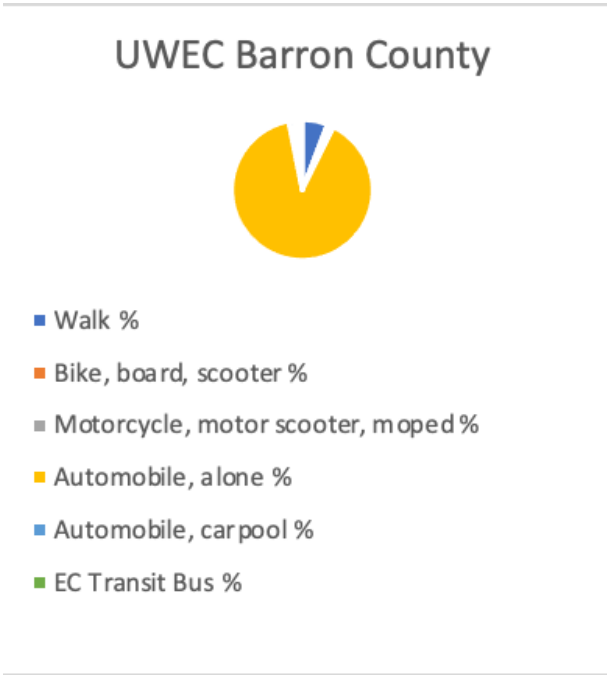
The results from the set of data for the percentages of transportation modes for faculty/instructional staff and non-instructional staff/administration from the Eau Claire, Marshfield, and Barron County campuses show that all three campuses, the majority of people's main mode of transportation was driving an automobile alone. Following driving an automobile alone, carpooling in an automobile and walking were in a distant second and third place. The other modes of transportation, bike, board, and scooter, motorcycle, motor scooter, and moped, EC Transit Bus, University Priory Shuttle or Conveyance Van, and Uber or Lyft rideshare all had relatively small percentage splits between them. This means that the majority of faculty/instructional staff and non-instructional staff/administration on all three campuses have high carbon-emitting modes of transportation. To obtain these values, the average values for employees who did not change their transportation mode throughout the year was weighted with employees who did change their transportation mode between warm and cold months for each mode of transportation.





As for miles per trip for each group, there was an error in the survey, which resulted in some respondents to not be asked that question, so results from the previous year were used instead. This ranged from 6.43 miles to 13.79 miles. For the number of weeks that non-instructional staff/administration came to the Eau Claire campus, the average was 30.83 weeks. The largest numbers of respondents were 43 people, indicating that they came to campus for only one to five weeks and 73 people who indicated that they came to campus for 49-52 weeks. These values are the highest in the data set, with another uptick of eleven respondents for 21 to 25 weeks. This most likely indicates a large number of people working remotely, people working in-person like normal, and people who started the year working remotely but switched to in-person. Barron County's campus did not have a similar trend, however. Their respondents averaged coming to campus 33.82 weeks out of the year, with four out of eleven respondents indicating that they came to campus 49-52 weeks out of the year and a decline in the rest of the responses. There were no Marshfield non-instructional staff/administration respondents. The number of weeks that faculty/instructional staff came to their respective campuses ranged from 24 weeks for Marshfield to 37.84 weeks for Eau Claire. These all followed very similar trends of the majority of respondents indicating that they came to campus during fall and spring more than winter and either summer session.

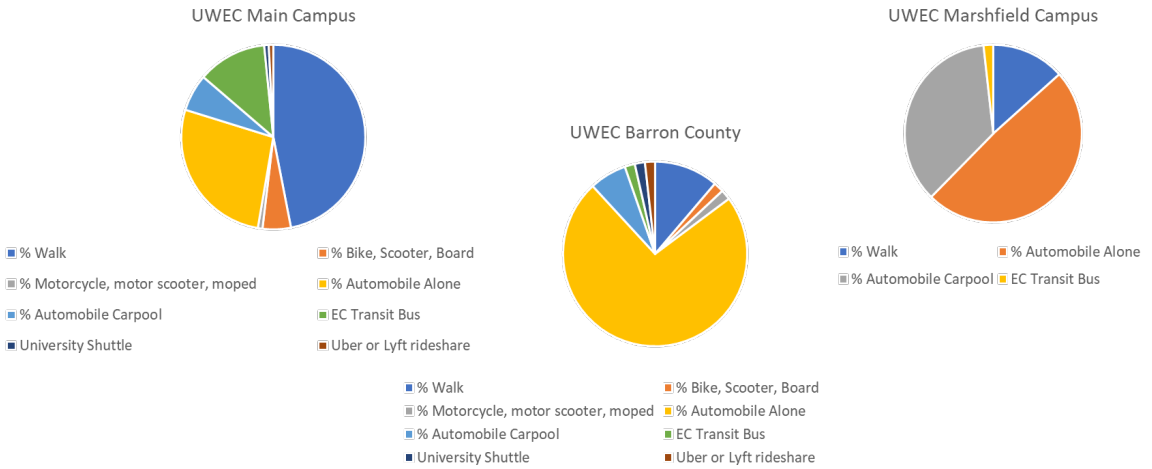




As for the number of trips that faculty/instructional staff made, the average numbers of trips per week were weighted for all of the terms. Similar to the number of weeks that employees were commuting to campus, more respondents came to campus during fall and spring than winter or summer for the most part. Eau Claire faculty/instructional staff came to campus an average of 8.17 times per week, Barron County faculty/instructional staff came to campus an average of 7.08 times per week, and Marshfield faculty/instructional staff came to campus an average of 4.67 times per week. There was no available data for non-instructional staff/administration on any of the three campuses.

Students

To obtain the amount of CO2 emitted from student commuting we needed, total student population, percent of each mode, the weeks of commuting, number of one way trips per week, and the average number of vehicle miles per trip.

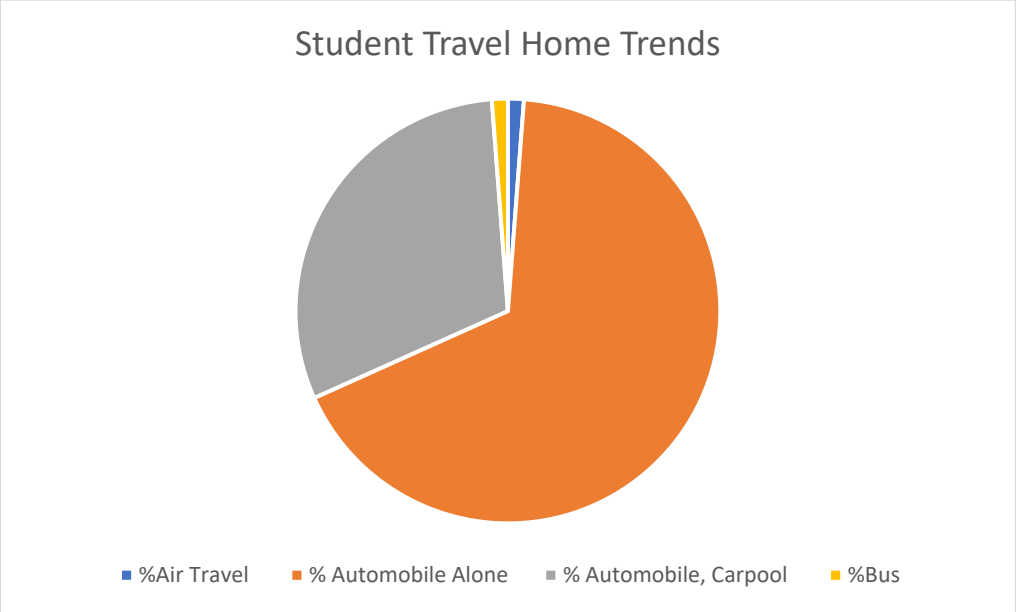


The results from the set of data for the percentages of transportation modes for students from the Eau Claire, Marshfield, and Barron County campuses show that for Main Campus students walking was the most common mode of transportation, and for students at the Barron County and Marshfield campuses, driving was the most common mode. On Eau Claire's main campus 46.9% of students walked, and 4.97% biked, scootered, or boarded. This results in just over 50% of student's transportation habits coming from non-carbon emitting sources. However, 27% of students drove alone, 6.48% carpooled, and 12.14% took the bus, while a small portion motorcycled, used the university shuttle or used ride share. The means that just under 50% of students commuting habits are from high carbon emitting sources. Marshfield and Barron County students showed the majority of modes of transportation being driving whether alone or by carpool. Marshfield students drove alone or by carpool 84% of the time and Barron County students drove alone or by carpool 80% of the time. To obtain these values the weighted average was taken from those whose transportation habits did not change throughout the year and those whose habits did change during the warm and cold seasons. The data showed that students were more likely to walk during the warmer months and drive during the colder months.

Weeks of commuting showed similar averages for each of the three campuses. Main campus having an average of 28.97, Marshfield having an average of 35, and Barron County having an average of 24.25. To obtain these values, the weighted average was taken from the fall semester, Winterim, spring semester, and both summertime terms (4 weeks and 8 weeks). One-way trips were computed a similar way as the weighted average for the fall semester, Winterim, spring semester, and both summertime terms (4 weeks and 8 weeks) were taken, however the number of total trips was more than the respondents as students are on campus for multiple terms. Main campus had an average of 9.2 one-way trips per week, Marshfield had an average of 4.47, and Barron County had an average of 7.73. There was an error in our survey when collecting the average number of vehicle miles per trip, so we used data from a previous year that showed an average of 8 miles per trip. We used the same number for all three campuses, as the previous survey did not include the specific data for each campus. To obtain the student population numbers we had to use the university's data book.

Student travel to home

To calculate the amount of CO2 emitted from students travel to and from home, the percent of each mode, the average number of trips, and the passenger miles per trip was needed. The survey found that 1.21% travel by plane, 67.07% travel by automobile alone, 30.5% travel by carpool, and 1.21% travel by bus. This data was taken directly from the survey results, no weighted averages were needed. The survey also found that the average number of trips was 6.61 and the average passenger miles per trip was 154 miles. From this data the MT of CO2 was found.



Discussion

The primary contributing factor for greenhouse gas emissions for commuting was students, faculty/instructional staff, and non-instructional staff/administration who drove an automobile alone as their main mode of transportation to and from campus. Just over 50% of students did say that they walk or use other non-carbon emitting modes of transportation, however the little less then 50% who do use carbon emitting sources, have a large impact on CO2 emissions. Faculty/instructional staff, and non-instructional staff/administration show even more significant percentages as for each group driving is their main mode of transportation over 70% of the time. Although they emit less CO2 than students overall, this is due to a smaller population size, and not due to more sustainable habits.

With this being known, initiatives should be taken to reduce people from using driving alone as their primary mode of transportation. An example of how this could be done would be encouraging more people to take the bus. Some reasons that people may not be taking the bus already could be that they do not know about it, they think it is too crowded, or they think that it takes too long to wait for it and arrive at their destination. These issues could be solved with more advertising of the bus and providing more buses/bus routes that have fewer stops to cover. Also, the data showed that those whose modes of transportation changed with the weather typically walked more in warmer months and drove more in the colder months. If campus could promote walking during warm months to

students and then taking the bus rather than a personal vehicle during the cold months, this could reduce the impact seen from driving. Although it is possible to try to encourage students and employees to take advantage of alternative modes of transportation, it could also be beneficial to instead discourage people from driving to campus alone. Although it would not necessarily be popular, fewer parking passes could be sold or they could be sold at a higher price.

Our student travel to/from home was a new addition to the survey, however the numbers proved to be profound. Student's trips home amounted to just over 3,000 MT of CO_2, which is almost equivalent to the commuting CO_2 emitted by all three groups. This data can be discouraging as there as the campus cannot control how often or how far students travel outside of campus. They can take some initiatives like promoting carpooling through ride share apps, however beyond that there is not much that they can do. That being said it can be debated whether this data should or should not be included in the overall campus footprint as it is not really a direct campus emitter. However, the data still proved to be informative, and if broadcast enough, could make students think twice about the trips that they take on the weekends.

Other travel emissions

Introduction

As a part of the campus carbon footprint, our group was tasked with analyzing the realm of "other travel" within the university. This required us to look at two scopes of emissions. Scope one analyzes emissions that come directly from the campus. In terms of this report, that includes on-campus vehicles and small engines. Scope three analyzes all other travel emissions associated with the campus. This includes city bus usage, charter bus usage, personal mileage reimbursement, and air travel by staff and students. The data we analyzed spanned from July 1st, 2020, to June 30th, 2021. The majority focused on the Eau Claire campus emissions, but a few from Barron County and CVTC had to be extracted and reallocated to different teams and their departments.

We were provided a variety of data sources and they were labeled as the following: "Immersions", which provided study abroad air mileage, "NSE" (National Student Exchange)which provided traveled air miles and driving distances by students, "Tendercare" provided charter bus miles, "EC Transit" provided city bus miles, "UW City Pairs" provided university-sponsored air miles, "Voyageur" provided on campus vehicle gasoline usage, as well as "Phoenix Fuels", "Student Transit" provided charter bus miles, and "Kobussen" provided charter bus miles for athletics. These data pages were compiled into four separate categories: Air Travel, which includes "Immersions", "NSE", and "UW City Pairs", Charter Transit ("Kobussen" and "TenderCare"), Public Transit ("EC Transit" and "Student Transit"), and Transport Fuels ("Phoenix" and "Voyageur").

In order to convert all of the information provided to us into greenhouse gas emissions, we first had to compile each category we were provided with (Air Travel, Public Transit, Charter Transit, and Transport Fuels) into a common unit. Transport fuels were organized into gallons of gas or diesel, while the remaining three were summarized as miles or passenger miles. A majority of the collected data did not need a supplementary conversion step, but some flights only provided destinations and departures, in which we had to use an online distance calculator to record mileage. After each category was converted, they were separately summed and then entered into SIMAP, an online conversion tool to provide us with the equivalent value in metric tons of carbon dioxide equivalent, or MT CO2e.

Scope 1 emissions

Scope one emissions at the University of Wisconsin-Eau Claire "Other Travel" emissions include Direct Transportation University Diesel and Gasoline Fleets, which entails on-campus vehicles and small engines used for various activities, such as landscaping, on campus. These emissions totaled 203.63 MT CO2e, or 22,339 gallons. As seen in the pie chart below, this is equivalent to approximately 2% of the University's entire emissions within scope one, with natural gas and distillate oil totaling to 265,356 gallons or 12,021.25 MT CO2e (the remaining 98%). Our emissions are a tiny sliver of UW-Eau Claire's scope one emissions, but these do not include bus and air travel, which is shown below in scope three emissions.

Scope 1 Emission summary

The Sources graph shows a detailed view of your results in table form.
Carbon

Fiscal Year	Scope	Source	Quantity	Unit	CO2 (kg)	CO2 (MTCDE)	Biogenic (MT CO2)	CH4 (kg)	CH4 (MTCDE)	N2O (kg)	N2O (MTCDE)	GHG MTCDE
2021	1	Direct Transportation Sources: University Fleet: Diesel Fleet	7,534	US gallon	76,562	76.56	0.00	0	0.01	0	0.06	76.63
2021	1	Direct Transportation Sources: University Fleet: Gasoline Fleet	14,805	US gallon	127,067	127.07	0.00	7	0.19	4	1.18	128.44
2021	1	On-Campus Stationary Sources: Distillate Oil (#1-4)	47,224	US gallon	479,890	479.89	0.00	68	1.92	4	1.09	482.90
2021	1	On-Campus Stationary Sources: Natural Gas	218,132	MMBtu	11,541,360	11,541.36	0.00	1,151	32.22	23	6.13	11,579.71
2021	1	On-Campus Stationary Sources: Solar - Electric (RECs owned)	19,633	kWh	0	0.00	0.00	0	0.00	0	0.00	0.00
2021	1	On-Campus Stationary Sources: Solar - Thermal (RECs owned)	30,635	kWh	0	0.00	0.00	0	0.00	0	0.00	0.00

Scope 3 emissions

Within UW-Eau Claire's scope three emissions, "Other Travel" includes: all university sponsored air travel for faculty, staff, and students as well as study abroad, charter bus, public bus, and personal mileage reimbursement. All of these categories total to 173.3 MT CO2e, or 223,011 traveled miles. The only other carbon emissions within this scope for the University come from electricity, steam, and chilled water: T&D losses which is 299.83 MT CO2e. This indicates that "Other Travel" CO2e emissions are about 37% of the entire scope three emissions on campus. Compared to scope one, "Other Travel" emissions take up a significantly larger portion of scope three emissions.

Scope 3 Emission summary

Fiscal Year	Scope	Source	Quantity	Unit	CO2 (kg)	CO2 (MTCDE)
2021	3	Directly Financed Outsourced Travel: Air: Faculty / Staff	47,996	passenger mile	21,017	21.02
2021	3	Directly Financed Outsourced Travel: Ground: Charter Bus - Diesel	32,019	vehicle mile	99,538	99.54
2021	3	Directly Financed Outsourced Travel: Ground: Personal Mileage Reimbursement	16,854	vehicle mile	6,008	6.01
2021	3	Directly Financed Outsourced Travel: Ground: Public Bus	80,178	passenger mile	26,326	26.33
2021	3	Electricity, Steam, and Chilled Water: T&D Losses	21,279,105	kWh	299,833	299.83
2021	3	Solid Waste: Landfilled Waste: CH4 Recovery and Flaring	1,571	short ton	0	0.00
2021	3	Study Abroad: Air Travel	45,964	passenger mile	20,128	20.13
2021	3	Wastewater: Central Treatment System: Aerobic	647,820	US gallon	0	0.00
2021	3	Wastewater: Central Treatment System: Anaerobic	365,946	US gallon	0	0.00
2021	3	Wastewater: Central Treatment System: Anaerobic Digestion	38,310,316	US gallon	0	0.00

Discussion

Within our realm of analysis, the most significant contributor was charter bus miles, however, compared to the entire campus footprint as a whole, “Other travel” categories contribute a small portion of emissions, largely due to reduced air travel during the COVID-19 pandemic. We have observed that, in regular years that are not impacted by COVID-19, levels of emissions are higher.

New to our data collection was the inclusion of TenderCare charter data, which handles the shuttle between the Priory residence hall and lower campus. Perhaps future contract development with these transportation companies should highlight the intent of collecting transportation data for the footprint analysis. Writing in a clause within contracts could make the company aware and responsible for maintaining accurate and qualitative records for quicker and more efficient data collection and help avoid these confrontations and issues.

A previously significant contributor to our carbon footprint has been air travel. However, there was a large reduction in this year’s report, which can likely be attributed to the COVID-19 pandemic’s effect on travel. This massive decrease in travel was unfortunate for students wishing to study abroad but gave us a convenient insight into how our footprint might look if the levels of emissions changed. We do not expect students to stop traveling abroad any time soon, and it is the highlight of many students’ college careers. Even so, we recommend that the university requires purchasing offsets with each ticket that is bought. This would mean each ticket would have a higher price point, but that raise in cost would go towards offsetting the carbon that is produced by the airplane.

Finally, our group recommends that the university researches and considers upgrades to campus vehicles and equipment. Over time, we expect that more efficient and clean technology will be produced. If the university takes advantage of these cleaner machines and replaces older and less efficient models, we expect to see a decrease in emissions from those sources.

Additional Scope 3 emissions

Introduction

This report is a summary of greenhouse gas emissions, specifically CO2 emissions, for the University of Wisconsin- Eau Claire based on an analysis of all expenses made by the university from the years 2018, 2019, and 2020. Since there was no data provided for the year 2021, the year we wanted to analyze in our work, we used the averages of the three previous years to get predicted values for the total expenditures of 2021 per sector. Our goal was to calculate a total of CO2 emissions as accurate as possible based on the information received and the website we used to make conversions between dollar amounts and CO2e amounts. We also wanted to identify major specific carbon dioxide emission sources.

Our project scope fell into scope three, which are indirect emissions produced by emitters, companies listed within analysis, but owned and controlled by a different emitter who reports emissions, UW-Eau Claire. All the total expenses and the expenditure breakdown were provided through a document named UWEC Spend Analytics. Through this data, we analyzed the different sectors the data was given in and eliminated the sectors including transportation, travel and accommodations, utilities and energy, and vehicles, since those sectors were encompassed within other CO2e campus analyses. Within the analysis, the total expenses in monetary values per year, total expenses per sector, and the total expenses for each top twenty vendor within each sector were provided. We then took the average of the total expenses per sector from the three years to use. We found the percentage of subsectors within the main sectors over the three years and used that percentage to find the average value percentages per subsector. We then converted the values to per million-dollar values. Using eiolca.net, a website that calculates greenhouse gas emissions based on the life cycle assessment of a product, we input the per million-dollar value and were given a total CO2e in metric tons.

While our analysis got as specific as it could with the information given and the resources available, such as vendor names and subsector category names, along with the LCA website, there were still a lot of limitations to our analysis. Many assumptions were made when matching our given data sectors into the LCA website sectors. When we had to make our own custom models to match specific sectors, such as the food and beverage sector, we were not able to get every specific item that goes into the food or beverage expenses only given the names of the vendors, rather than all the specific ingredients that go into the items. Even with more research into the specific vendors and companies, we were not able to grasp the full vastness of each material used. This vagueness within the specificity of the sectors could have skewed the final CO2e values due to the way we input the values. Another limitation was not having any data truly reflective on the year 2021. Using previous years' numbers and taking the average of them could be skewed due to any yearly outliers. Although there are a couple of limitations and uncertainties to the analysis, the expenses are proof that we are still, as a campus, emitting greenhouse gases, creating a need for further preventative actions to be taken.

Results

All the numerical values and calculations explained prior were provided or able to be calculated from the UWEC spend analytics document. Using the average total expenses from 2018, 2019, and 2020, we were able to use that value to calculate the percentage each sector contributed to each sector and calculate a per million-dollar amount. We were able to switch from dollar amounts to amounts of

metric tons of carbon dioxide equivalent through the easy entry LCA website. Our spreadsheet data values were in dollar amounts per million dollars. Upon entering the per million-dollar amounts, a CO2e total value was outputted and those were the numbers we used within our analysis.

Sector Name	Per Million Dollars	CO2e (Metric Tons)
Animals and Farming	0.078916	64.3
Arts, Sports, and Rec	0.498131	293.075
Business Support Services	1.101293	121.775
Charitable and Religious	0.0098723	2.061
Clothing	0.3351	142.38
Education	4.59596	1588.68
Facilities	13.41959	4569.1
Financial Services	0.512574	49.483
Food, Beverage, Catering	0.4589493	357.308
Healthcare	0.3377	67.84
Human Resources	0.17559	30.2
Information Technology	5.030204	407.606
Laboratory	0.6254	143
Legal	0.0085403	0.795
Marketing and Media	1.665309	229.05
Office Supplies	0.3752	496
Other Goods and Services	0.035675	0.353
Professional Services	0.0821457	9.525
Public Sector	2.1164	475
Retail and Wholesale	0.22448	45.462
Social Care and Services	0.091877	33.5

Figure 1: Table representing the per million-dollar amounts entered into the LCA website by sector and the outputs of CO2e in metric tons.

From the average expenditures of the three years of data given, the total CO2e was 9126.491 metric tons. There were a couple of outlying sectors that seemed to contribute more than the rest to the total measurement. The facilities sector, consisting of cleaning and janitorial equipment/services, fittings and furniture, facilities management, grounds maintenance, mail services, and property and real estate, contributed 4569.1 MTCO2e. The education sector, compromised of education service, educational equipment (books, print media, newspapers), higher education and primary/secondary education contributed 1588.68 MTCO2e. The public sector contributed 475 MTCO2e, which is made up of city and state law enforcement and government. Information technology was compromised of data communications, IT hardware and software, IT services, systems integration, and telecommunications and gave 407.606 MTCO2e to the total emissions. Another larger contributor was office supplies, which was the majority of stationary supplies, such as paper. This sector contributed 496 MTCO2e. These outliers are obvious in the charts shown below.

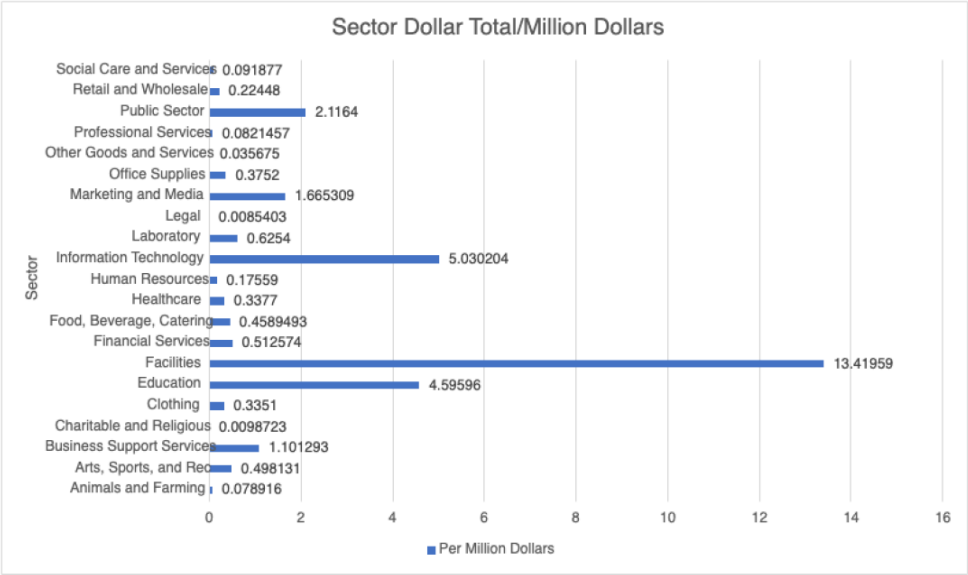


Figure 2: Graph representing the per million-dollar amounts entered to the LCA website broken down into sectors.

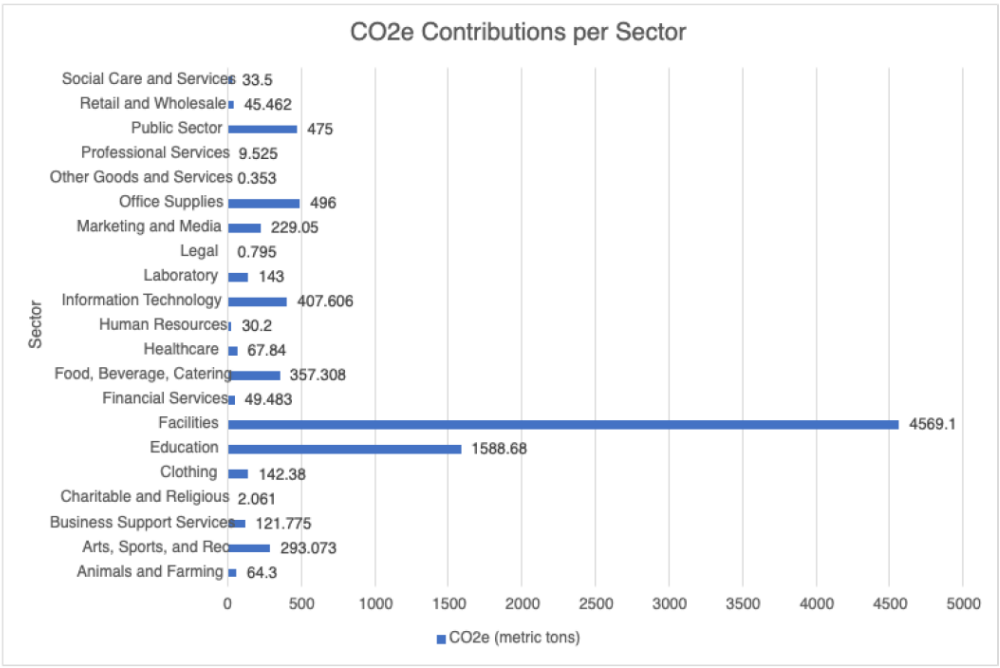


Figure 3: Graph representing the CO2e per sector contributing to the overall CO2 emissions calculated.

Discussion

After determining the campuses greenhouse gas and CO2 emissions, we were able to analyze the effect it had on the campus as a whole. Throughout our analysis we came up with lists of limitations, takeaways, and recommendations for the campus on ways to limit carbon emissions.

The main limitations our group found centered around the eiolca.net website. Due to the fact that this website did not provide many details or specifics on the provided subsectors, we needed to make multiple generalizations. Using the spend analytics document, we categorized each upstream purchase into the subsectors listed and entered the data into the LCA website as best as we could. When certain subsectors fell within multiple LCA categories, we utilized the custom model tool. Using this allowed us to gain a more accurate depiction of emissions when the source categories were listed very broadly.

Additionally, our group ran into some issues when fitting businesses and vendors into the predetermines sectors. However, with a little research, we were able to learn about the vendor and determine the correct group. For example, in our list of company names, Bry the Fish guy was listed under Animals and Farming. We later found out this company oversees the aquarium care and design for the Davies fish aquarium located on the second floor of the Davies center.

Our last limitation deals with the spend analytics document. When looking into the top vendors, we found that some categories were listed twice under the same category. The main example of this can be found under the facilities sector. Under facilities, Sodexo inc. is the top vendor making up 35.93% of the total spent under this category. However, the second largest spender is Sodexo, inc. with 20.13% of the total. Both add a significant amount to the facilities sector, but it also left us with questions as to how the data was entered to find each total.

Breaking it down into specific categories, our group was surprised to find out that the facilities subcategory contributed approximately 50% of the total CO2e. After careful thought, we determined it was because of grounds machinery, gasoline usage, and Sodexo being listed under facilities instead of food. Sodexo is not only in charge of all food services on the university, but the company is also in control of hiring food service employees, categorizing it as facilities management. This in turn lowered the food sector and drastically increased the emissions for facilities.

Additionally, the public, education, and arts, sports, and recreation sector had interesting results. The public sector included city and state law enforcement. Prior to this analysis, we had assumed that only local city data would be included. Looking at the education sector, it included bookstore merchandise as well as study abroad opportunities. Many students take part in study abroad opportunities here at Eau Claire, and therefore the payments towards international universities are quite extensive; currently, there we have over eight universities listed for study abroad partnerships. Also included in the education sector were payments towards UWEC itself, which we found interesting and were unsure what this went towards. The arts, sports, and recreation sector had expenses towards the Pablo Confluence Center. Additionally, it listed Fleet Feet as a top vendor, which we determined was because of the screen-printing service they offer for recreational club apparel at the university.

Recommendations

By looking past our limitations and creating key takeaways, our group was also able to determine some recommendations for how the university can cut back and lower our CO2 emission levels. Recommendations include switching from paper textbooks to online formatted options, using electrical grounds equipment rather than gasoline, and utilizing more local foods instead of relying solely on Sodexo.

Majority of the office supplies sector was comprised of paper companies. The primary contributors in the education sector also came from textbooks at the bookstore. Making the switch from these paper components to more online formats would cut down costs in both these categories. We acknowledge that there will likely always be the need to have physical copies of certain paperwork, but any reduction in paper use would still prove to beneficial in lowering emissions.

Our next suggestion dealt with the ground's equipment on campus. Transitioning from the use of gasoline to electric powered is just a start to lowering gas emissions in this area. In general, electric motors are a far more efficient substitute.

We also wanted to look at how we could lower the costs made to Sodexo. Sodexo is currently the University of Wisconsin Eau Claire's main upstream cost. However, there lies an issue with figuring out how to lower the emissions levels without cutting off food production for the students. Our solution was to take advantage of locally grown food sources. The university could even begin its own garden to supply some fruits and vegetables for itself. While it may not be much in terms of how much we purchase from Sodexo, it would be a start to the improvements.

Lowering the carbon footprint of an entire campus can be extremely difficult. There are many people, buildings, and facilities that need to be properly taken care of in order to stay up and running. Of course, there are certain areas that just cannot be improved beyond a certain extent; there will always be the need for food, healthcare, sporting facilities, etc. However, even implementing these small changes in some categories can have a considerable impact on the university.

Renewables, offsets, and sequestration

Introduction

Our analysis focused not on the emissions the campus generated, but those it didn't plus sequestration. Components of our analysis included scope 1 on-campus renewable sources- Davies solar thermal array and the McIntyre solar array. The Davies solar thermal works to heat water in the Davies Center year-round. Solar power heats a solution of water and propylene glycol (to keep the water from freezing). The solution is pumped through a heat exchanger and heat is transferred to water stored in tanks- that now hot water is circulated throughout the Davies center. This is an alternative to the hot water produced by steam from natural gas boilers that is used in other buildings. The solar panel array on the roof of the library provides clean energy and is an alternative to the energy purchased from Xcel Energy. Scope 1 emissions are those that are owned or controlled by the University.

A large part of our analysis was the analysis of renewable energy certifications, or RECs. RECs are, according to the EPA, "tradeable, market-based instruments that represent the legal property rights to all non-power attributes of renewable electricity generation" they allow the owner to make environmental claims regarding the power source (U.S. EPA Repower Toolbox). RECs are a sort of certification of ownership of one megawatt-hour of renewable electricity. When a person, organization, or institution owns a renewable energy source, a REC is issued to them for every megawatt-hour of electricity generated by that renewable energy source. UWEC gets RECs from many different places. UWEC purchased 10% of the Xcel solar array in Eau Claire through the Solar Connect program. The university keeps the RECs from these solar panels, while the actual energy generated is sold back to Xcel for a credit on their bill. UWEC also participates in the Renewable Connect program, where the campus pays a surcharge on blocks of electricity to Xcel, who puts that money towards building more renewable energy sources. Xcel then retires the RECs from those energy sources to UWEC. Additionally, UWEC gets RECs from the Davies thermal and McIntyre Library solar arrays, as well as through UW-System Green Power Purchases. RECs make up the scope 2 contributions of our analysis- those that are indirect emissions from purchased energy

Additionally, our analysis includes UWEC land holdings, like Putnam Park, and composting. These sources are considered in scope 3, indirect emissions outside of scope 2.

To gather our data, one of our biggest tasks was to look through campus Xcel Energy bills. This was how we complied data for the Renewable Connect and Solar Connect RECs that belong to the university. This data was provided in kWh by Tony Rongstad/Alison Millis and Oscar Brandser, our Xcel Energy representative.

Davies solar thermal and Library solar data were provided to us in large lists of compounding data, so we subtracted the value in June 2020 from that of June 2021 which gave us the value produced in the academic year we are studying. Davies solar thermal data was provided in BTUs, which we converted to MMBTU for SIMAP input. Data from the library solar array was provided in kWh, so no conversion was needed. Jay Hanson from the UWEC facilities staff provided library solar and Davies solar thermal data.

The UW-System Green Power Purchase data is from the 2020 academic year because that was the data that was available to us. This was provided in kWh, so no conversions were needed; data was

provided for both the Barron County campus and the main campus, so both were included in this analysis. John Willis Garder from UW System sustainability provided these data.

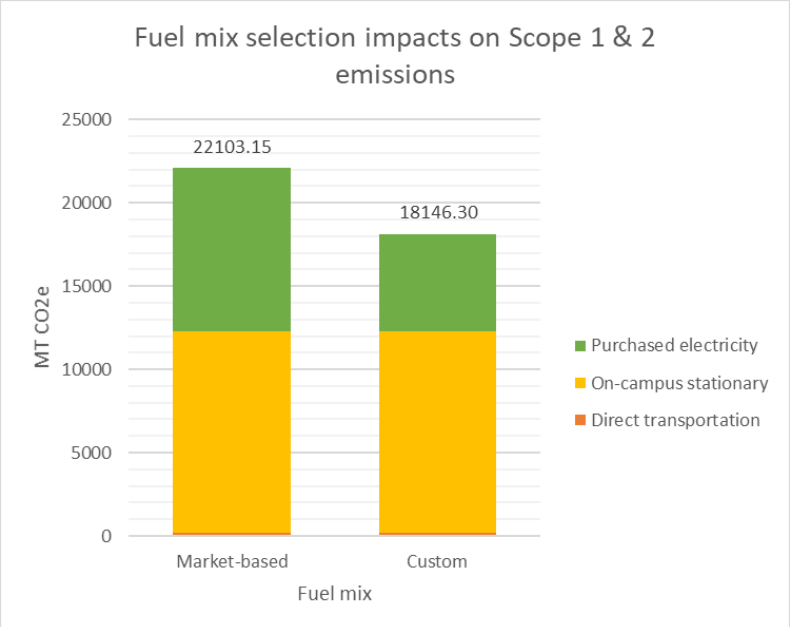
Composting data was collected from June 2020- June 2021. We received data from both the 2020 and 2021 calendar years, so we identified the correct months for our analysis and focused on that data. For both calendar years, data was provided in short tons. Non-additional sequestration did not change from last year, and was provided in MT eCO2, so conversation was not needed. Kimera Way of the UWEC Foundation provided this data and on-campus composting data was provided by Bernie Waldoch of UWEC Facilities.

Results

SIMAP provides us with two pathways to examine our data - one with a custom fuel mix for energy generation, the other with a market-based fuel mix. We explored each pathway to gain a better understanding of the implications of our data. Taking first the custom fuel mix, SIMAP allows us to input the custom fuel array that Xcel Energy provides to our region: Coal: 21%, Natural Gas: 32%, Nuclear: 13%, Wind: 27%, Solar: 3%, Other Carbon Free: 4%. Following this pathway, RECs owned and purchased do not contribute to our carbon footprint. To better understand what RECs should have contributed, we were able to use a kWh conversion to determine the amount of eCO2 that was kept from being emitted by our scopes 1 and 2 renewable sources.

Following the best practices from the GHG Protocol, SIMAP recognizes that RECs should not be counted against emissions. Instead, when using the market-based fuel mix, RECs will serve to lower the amount of kWh of energy used by the organization. When taking this approach, SIMAP applies the market-based fuel mix based on region. Our market-based fuel mix is as follows: Coal 44%, Natural Gas 11%, Nuclear: 11%, Wind: 25%, Solar: 1%, Other Carbon Free: 8%.

Figure 1 shows scope 1 and 2 emissions for each pathway. Here we can clearly see that with a market-based approach, the University's carbon footprint is greater because the emissions from purchased electricity is greater. When comparing these two pathways, it becomes evident that the market-based fuel mix is a lot more fossil fuel intensive. However, with this approach RECs are being counted against the total kWh purchased by the University. Taking the custom fuel mix pathway, the total scope 2 contributions to the campus carbon footprint are 21,279,105 kWh which yielded a total of 5,878.67 metric tons of eCO2. With the market-based fuel mix approach, the campus was responsible for 16,688,050 kWh, after the subtraction of RECs, which yielded 9,835.47 metric tons of eCO2. Even though the University was responsible for fewer kWh in scope 2, it had greater scope 2



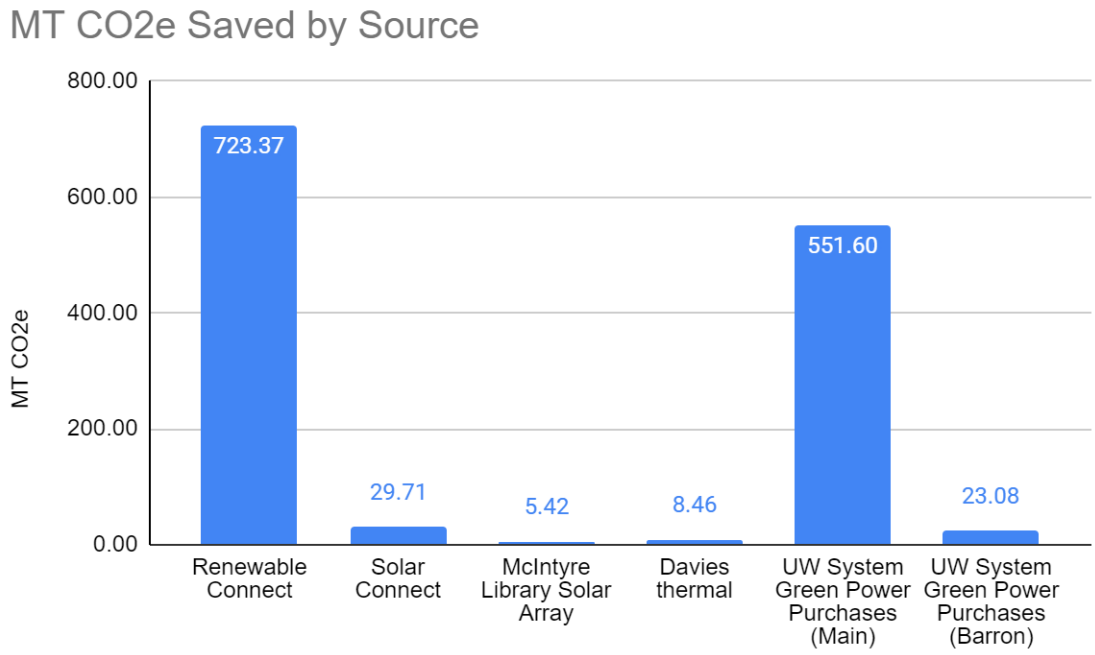
eCO2 emissions because the fuel source was more carbon intensive.

Figure 2 shows the tabular data for all the renewable sources that UWEC uses. The conversion from kWh hours to metric tons of eCO2 was calculated by using the SIMAP data for purchased electricity and dividing the total metric tons of eCO2 by the total kWh. This resulted in a conversion factor of 0.000276 MT eCO2/kWh. The total kWh for each source was then multiplied by this conversion factor to find the total metric tons of eCO2 saved per source.

Source	kWh	MT CO2e
Renewable Connect	2618400	723.37
Solar Connect	107550	29.71
McIntyre Library Solar Array	19633	5.42
Davies thermal	30635	8.46
UW System Green Power Purchases (Main)	1996650	551.60
UW System Green Power Purchases (Barron)	83550	23.08

Figure 2.

The energy saved by each renewable source is a total of 4,856,418 kWh. The Renewable Connect program and UW System green power purchases contributed the most in this area. However, though the solar arrays on campus are outstripped by other sources, the 50,268 kWh produced by these solar panels is still a large amount: enough to power 930 refrigerators for one month. Figure 4 shows the total metric tons of eCO2 saved by each renewable source. Again, the Renewable Connect program and UW System green power purchases have the biggest impact. In total, UWEC saved 1,341.66 metric tons of eCO2 by using these renewable sources and programs, though this number does not count in the SIMAP entry because of the use of the custom fuel mix as described above.



Conclusions

The question that remains is which of the SIMAP pathways is a more accurate representation of our campus' carbon footprint. Taking on one hand the fact that our purchased RECs should be counting against the footprint, one would think that the market-based approach is more representative of all contributing factors to calculating the footprint. On the other hand, an argument could be made that the custom fuel mix approach is more representative because it considers the actual fuel mix that is used by the University's energy provider. Neither of these pathways is perfect, and the tradeoffs are important to consider in our reporting.

It is important to understand that the fuel mix used by Xcel Energy is not under the control of the University. Instead, the University is lucky to have an energy provider that is working to build their grid through renewable energy means. While it is certainly advantageous of the University to report a carbon footprint that reflects this progress made by Xcel Energy, it does little to reflect the University's commitment to and progress towards reducing its emissions. Using this method, we see the carbon footprint of the University decline overtime without getting at the fundamental goal of the University which would be to reduce energy consumption in scopes 1 and 2, as it is the contributions of Xcel Energy that is lowering the footprint of the campus. The market-based fuel mix approach might seem to skew the data as it considers a more fossil fuel intensive fuel mix, but it does a better job of reflecting the University's own contributions to lowering its footprint by including RECs.

Renewable Connect REC purchases were the biggest contributor of saving eCO2of the renewable, offset, and sequestration sources we analyzed. Renewable Connect REC purchases saved nearly 725 MT eCO2. This was followed by UW System Green Power Purchases which saved just over 550 MT eCO2. Scope 1 renewable sources contributed to saving the least amount of eCO2 with a combined 13.88 MT eCO2saved.

On campus composting did not count against the footprint because it happens offsite, and thus is outside the scope of our footprint analysis. Similarly, University land holdings do not count against the footprint. The undeveloped land like Putnam Park does not count against the footprint because the University was not responsible for the creation of that wooded area, and it does not earn credit for not cutting down a large natural area. Developed areas could count against the footprint if it was developed in a restorative manner that took industrial area and returned it to a natural state that allowed for new carbon sequestering because many new plants were planted.

It is our recommendation that the University pursues onsite composting, as this would count against the footprint. With the new BluBox initiative, there is the potential to limit compost waste contamination, making it feasible to pursue onsite composting. Additionally, the restoration of habitat around the new Sonnentag Complex has the potential to contribute to non-additional carbon sequestering as a largely concrete area is replanted.

Investing in more onsite renewable energy will also reduce the carbon footprint. With less reliance on purchased electricity, the question from before about which pathway to use in reporting becomes less important as the University lessens its dependence on purchased electricity all together.

In future years, we recommend the switch to a market-based fuel mix. This pathway is more representative of what the University is doing to lower its footprint, and it makes more sense of the

RECs that the University is using. As the land around the Sonnentag Complex is developed it will be important to evaluate it to determine if it should count as a source of sequestration.

Finally, we would like to remind readers that regardless of how this data is entered into SIMAP, the contributions of offsets, renewables, sequestration are incredibly important. No matter how small these seem in the scheme of the entire footprint, they are not menial. The University's investment in these emission-reducing components demonstrate the institution's commitment to a more sustainable and just future. We agree with the sustainability goals of the University and urge an even greater investment into emission reduction strategies.

Credits and Acknowledgements

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Acknowledgements:

- Aaron Turek, Faculties Management
- Alison Millis, UWEC Facilities Business Analyst
- Anita Spahn, UWEC Resource Support Tech
- Arjen Van Dijk, Admin. Manager, Finance and Administration
- Bernard Waldoch, UWEC Custodial Services Supervisor
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- Oscar Brandser, Xcel Key Account Manager
- Ryan Banazsak, Housing & Residence Life
- Shawn Seuferer, UWEC ASK Program Manager
- Student Office of Sustainability, Maddie Loeffler, Director
- Sue Kluesch, Barron County Academic
- Tom Wagener, Eau Claire Transit
- Tony Birrittieri, Petersen Products, LLC
- Tony Rongstad, Facilities Management
- Vicki Wenger, Housing and Residence Life