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Salve Regina University Act on Climate: Strategic Plan for the University to Reach State Carbon Neutrality Goals

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Salve Regina University Act on Climate:

Strategic Plan for the University to Reach State Carbon Neutrality Goals

Jared Barrows, Casey Bermingham, Dylan Bigansky, Avery Braccia, Natalie Bryant, Claire Cavanagh, Jerry Cheatham, Alexander Colon, Courtney Connor, John Deady, Finn Doherty, Mary Duman, Mia Farley, Alexander Gajic, Brandon Grover, Andrew Hassler, Dhana Hinds, Abigail Hoye, Emma Karpinski, Genevieve McClelland, Stella McCormack, Maggie McCue, Emma McGrillen, Kelly McKenna, Gianfranco Messina, Liam Murphy, Maeve Newton, Mia Pastorok, Tyler Petrosino, Samuel Richard, Marion Riddle, Allison Sagun, Jessica Serra, Aidan Tucker, Patrick Voli

BIO-140: Humans and Their Environment

Dr. Jameson F. Chace

April 20, 2022

Executive Summary

In order to become more sustainable and meet the mandate set by the 2021 Rhode Island Act on Climate law (RI General Law §42-6.2), Salve Regina University must work to reach net-zero greenhouse gas emissions by the year 2050. Action to meet these standards begins now and must be continually built upon to ensure that Salve Regina University, as leader in Rhode Island, is always working for a more sustainable future. Throughout the Spring 2022 semester, students of the BIO-140: Humans and Their Environment course instructed by Dr. Jameson Chace have researched ways in which Salve Regina can begin on the path to zero greenhouse gas emissions today. By focusing on change in the areas of energy, transportation, food, financial investments, and sequestration, Salve Regina can reduce the greenhouse gas emissions of today for a more sustainable tomorrow. Recommendations are broken into three time periods. Action for today to achieve by 2030 include improving energy efficiency, installing the first electric vehicle (EV) parking/charging stations, increasing carbon sequestration, reducing beef in the campus diet, and assessing the carbon impact of university financial holdings. Actions to be initiated soon and to be achieved by 2040 include shifting away from natural gas heating when system renewals take place, increasing EV parking to meet rising demand, during turnover replace current university vehicles with electric or hybrid, continuing with sequestration efforts on campus, begin phasing out high carbon diet items, and by 2040 the university investment portfolio should be carbon neutral. If carbon neutrality can be reached by 2050 the most challenging aspects of campus life that need to change will require planning now and thoughtful implementation. The class in 2022 envisions a campus in 2050 where solar lights illuminate campus and buildings through the night, all university vehicles and most faculty and staff vehicles are electric and are found charging during the day at solar powered charging stations, dining services in Miley supports community agriculture and includes incentives for meatless and low carbon meal plans, the university has become a leader in low carbon/green market investing demonstrating how careful planning can reap high returns, and carbon sequestration on campus grounds has maximized such that off campus carbon offsets are established with local land trusts to complete the carbon neutrality goals. In doing so not only will the university be recognized as a state-wide leader in climate action, but will also be a global leader in working towards a world that is more harmonious, just, and merciful.

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Introduction

Since the mid twentieth century, carbon emissions have been steadily rising due to an increase in industrialization (Environmental Protection, 2022). If emission rates continue to increase, the world will be unable to sustain life as we know it. Fortunately, the 2021 Act on Climate law, signed by Governor Dan McKee, mandates that Rhode Island reaches net-zero greenhouse gas emissions by the year 2050 (State of Rhode Island Climate Change, 2021). The bill is a huge step toward creating a livable future on our planet, and the Salve Regina University community can be leaders toward this positive change.

Salve Regina has the responsibility to become more sustainable and active in reaching net-zero greenhouse gas emissions by 2050. Students, staff, and faculty of Salve Regina are all familiar with the five Critical Concerns of the Sisters of Mercy (Critical Concerns, n.d.) which serve as pillars in our curriculum and community. One of these critical concerns is Earth (Critical Concerns, n.d.), and as a collaborative university, it is our responsibility to acknowledge this concern by taking action to reach net-zero greenhouse gas emissions.

Attaining this goal will require action in five main areas: transportation, food production and consumption, energy efficiencies, financial investments, and sequestration. By adapting our current focus and processes, great improvements can be made within these areas. Such steps include reducing gasoline used by on-campus vehicles, increasing sustainability in our dining facilities, investing in technology that is more energy-efficient, spreading awareness and support of carbon-neutral companies, and increasing protection and promotion of natural processes of sequestration on campus. These individual improvements will reduce the carbon emissions of Salve Regina University and aid in the success of reaching zero carbon emissions by the year 2050.

Energy

Finn Doherty, Brandon Grover, Gianfranco Messina, Tyler Petrosino, Allison Sagun

On April 14, 2021, the governor of Rhode Island signed into law the 2021 Act on Climate. This law sets mandatory and enforceable climate emission reduction goals that will lead the state to reach net zero emissions by 2050 (State of Rhode Island: Climate change). Reaching net zero emissions in the state of Rhode Island is just a small step in the right direction to reach carbon neutrality on a global level. It is important for communities locally, as well as globally, to reduce their carbon emissions because if they do not do this collectively, the climate will continue to warm (IPCC 2018). Salve Regina University can be a leader in this community by acting and becoming more energy efficient. As students at Salve Regina University, we must take into account the Five Critical Concerns of the Sisters of Mercy and we must uphold these values. One of these concerns is Earth. As of right now, the university is not upholding this concern due to the amount of energy we are using. Using nonrenewable resources to power our university is harmful to Earth because they release greenhouse gases into Earth's atmosphere.

Methods

We conducted our studies by examining our university. From dorms to classrooms, there are many apparent energy inefficiencies that we attempted to quantify, we did not try to quantify every aspect of energy efficiencies. We then took our knowledge from class lectures and related it to how we can help the University become more sustainable with its energy use. We looked for the areas that we would discover the biggest environmental impacts and thought of ways to provide an alternative solution that is more sustainable. To find information based on the Campus' Carbon footprint, we examined documents (e.g., monthly electrical bills) that held information regarding energy use for the University.

Results

Being a school on a historic campus with older buildings, there are a lot of changes that would need to be made in order to make an effective and sustainable change for the future. Large buildings for summer use, with high ceilings and materials designed for aesthetic rather than thermal conductance or solar gain, makes for a challenging location to achieve energy efficiency, and especially so when local law prohibit altering the buildings in a manner that might modify early 1900 architecture. These inherent energy inefficiencies not only harm the Earth but also harm the University's bottom line, and are some of the most significant challenges to meet the 2050 goals. However, there are some inefficiencies that are simple fixes and not something that would cause a complete overhaul of a building's infrastructure or external appearance. Others will require substantial investment and planning, but would have significant climate benefits if acted upon.

Electric

The 2021 Act on Climate Law states that the State of Rhode Island needs to reduce climate emissions to net-zero by the year 2050. This will require moving away from Natural Gas, a significant source of the electrical grid (Figure 1), but also the primary heating (hot water and forced hot air) on campus. The State is already moving towards a carbon free electric grid and

thus the university does not need to focus intently on the carbon footprint of eclectic use, however the cost of electric utilities is forecasted to increase and thus is would be prudent to improve efficiencies. The most significant issue for the campus is reducing Natural Gas use for heating air and hot water, eventually phasing it out and replace it with a clean and renewable energy source by 2050.

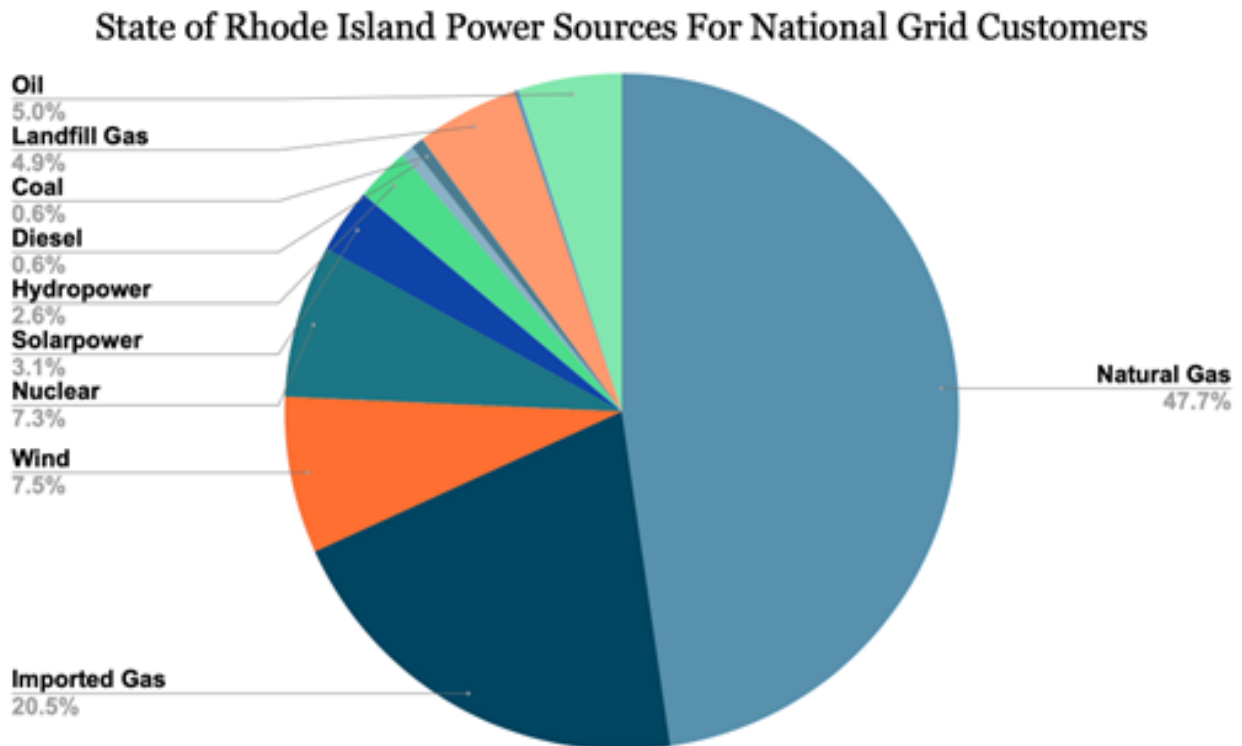
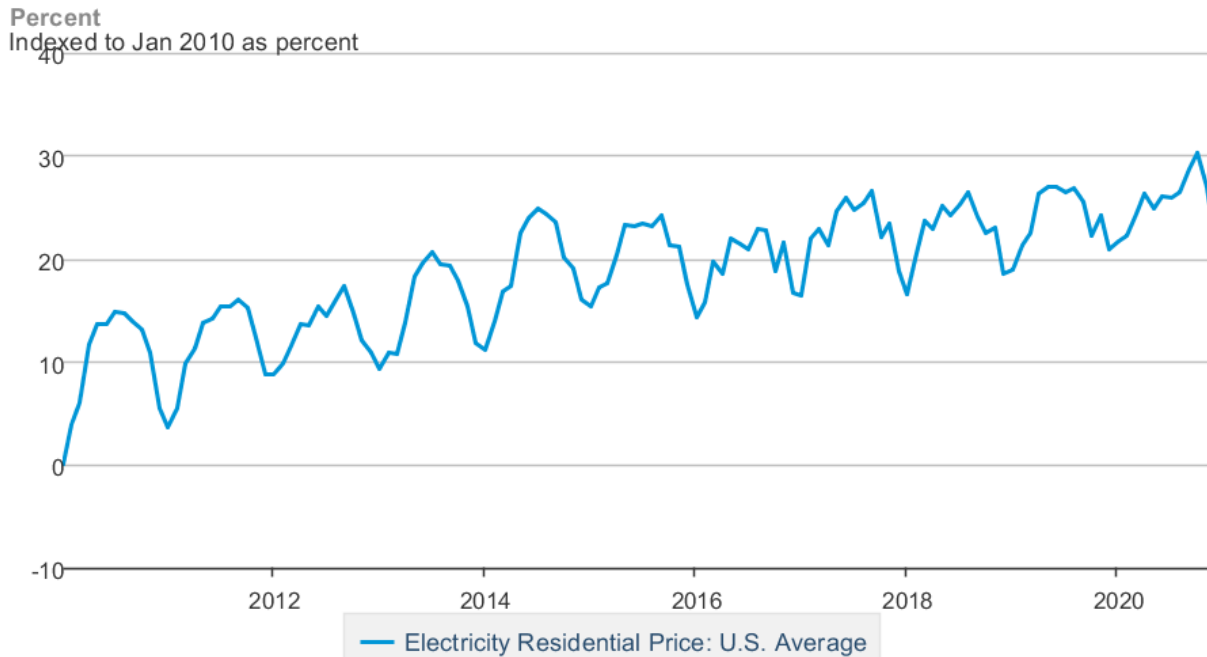


Figure 1. Power source distribution for the state of Rhode Island National Grid customers, November 2021.

As electric rates will continue to increase (Figure 2), Salve should also consider investing in harnessing their own energy. A great way to accomplish this would be to harness solar energy. Being a historic district, solar panels are bound to cause some criticism and reluctance to make this investment. However, off site solar fields are possible solution if rooftop solar is not an option. Future of solar panel construction may be less intrusive and blend more seamlessly into the architecture (National Park Service), and if so the university should be prepared to invest in these as an agent of change in the historic district and to improve the bottom line as electric rate climb.

Salve Regina University used 5,650,455 KWH of electricity in 2020-2021(Electric Use by Campus). That electric bill amounted to \$1,145,491. The University needs to invest in renewable clean energy in order to reduce their carbon footprint, but without their own energy production or significant increase in efficiency this is going to result in spending more money for cleaner energy.

Electricity Residential Price: U.S. Average



eia Source: U.S. Energy Information Administration

Figure 2. US Energy Information Administration graph of US electricity rates 2010 to 2025.

Natural Gas

Natural Gas is a non-renewable energy source, meaning that it is a limited resource and will eventually run out. What we need to consider is the detrimental impact Natural Gas has on the environment. Currently nuclear, wind, hydropower and solar comprise only 20% of the states' energy sources that do not emit greenhouse gasses.

Last year alone, the university used 44,846 million cubic feet of natural gas (Figure 3) for heating buildings and water. That converts to roughly 2,150 US tons of carbon dioxide emissions in a single year (Environmental Protection Agency). The increase in the amount of carbon dioxide creates an overabundance of greenhouse gasses that trap additional heat. This trapped heat leads to several environmental impacts such as ocean levels rising which will lead to coastal flooding (Lamb, 2019). For Salve Regina to comply with the 2021 law, they need to significantly reduce their use of natural gas and move towards an alternative energy source.

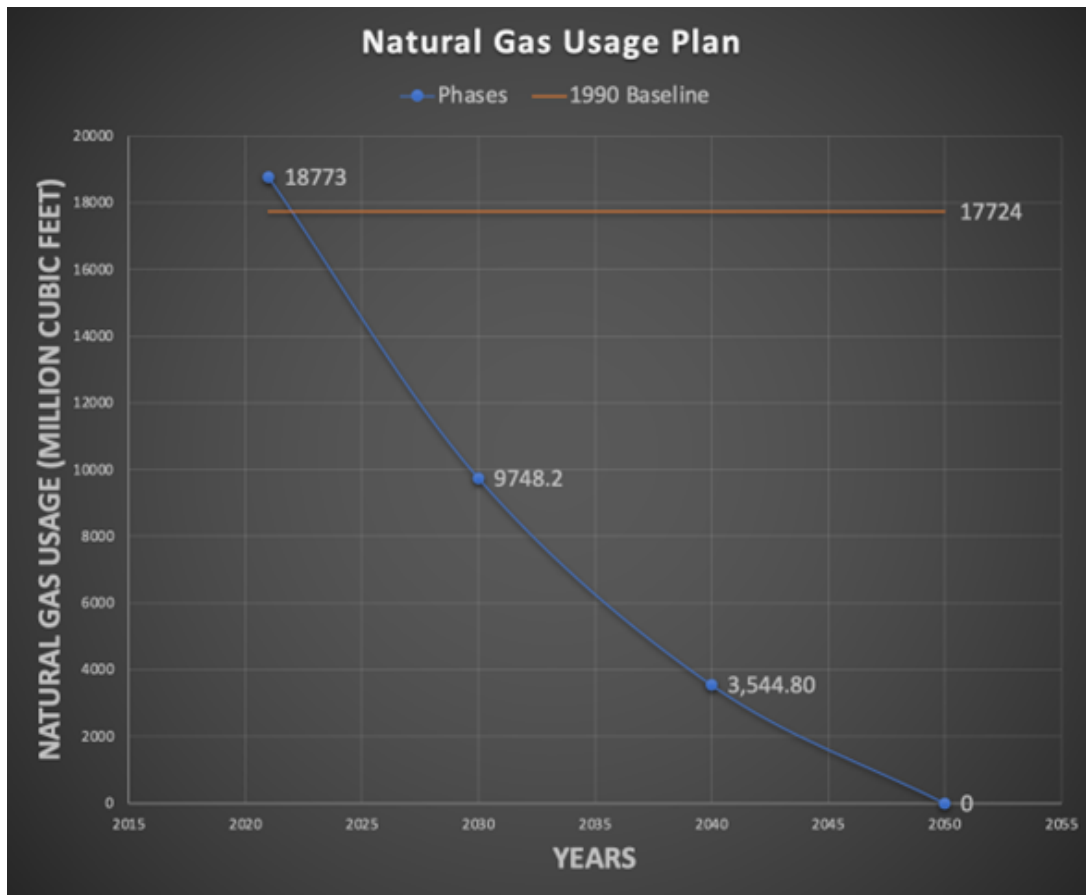


Figure 3. Natural gas use by campus maintaining a status quo and with a phase out plan.

Solutions

It is easy to say what needs to be done but it is hard to point out an alternative solution. Simply, the HVAC system at the University currently runs on Natural Gas. Eventually it will come time when a new HVAC system will be needed to replace the current one. When that time comes, the University needs to choose a system that is run on clean renewable energy. Down the road we could have new technology that will change the landscape of HVAC systems. Whenever that time comes, the University needs to steer away from natural gas and needs to choose the more environmentally friendly option, even if it means they must spend more money.

The campus has many inefficiencies that are causing excessive use of energy. Outdoor lighting could be replaced with solar-powered lights. This would be a cleaner and more efficient solution to the current wired lights. Appliances such as washers and dryers can be more energy-efficient as well. When it comes time to replace the current appliances, it would be smart to substitute the washers with the Samsung - WF45A64**A*. The dryers can be replaced with either the [Midea - MLE27N5AWWC](#) or the [Insignia - NS-FDRE44W1](#) (Energy Star). These are more energy-efficient than the current ones.

The university could also benefit from some renovations as well. The older style of the campus has caused a great deal of energy loss due to excessive usage. Lights are left on overnight which

uses energy when it does not need to be used. Some alternatives to this would include putting lights on timers, getting dimmers for later hours of the day, or even motion sensors so the lights are only in use when they need to be. Something else the campus should look at is the windows and doors. It is often that we find drafts in buildings due to doors and windows not shutting all of the way. This causes the heat to be constantly running which is a waste. If we fix those windows and doors, the campus could save a lot of money and a lot of energy.

Another area to look at is water heating. As of now it is heated with natural gas. Sometimes the showers take a while to heat up which is a waste of water and money. The University should look into some more energy efficient models for water heaters such as Acevedo Solar Systems' - International Solar System: Solar Water Heater Unit 3. This unit is solar powered which is a great alternative to water heaters that are powered by natural gas/electricity (Energy Star).

As for water boilers, the three main options for these include natural gas, propane, and oil. Natural gas is what the University uses now, so if there are current needs for replacement, we can look at the Energy Kinetics - Accel CS EK1C 90 which is more energy-efficient (Energy Star). However, it is still run by natural gas. When the time comes when there are other options that use renewable energy and not natural gas, oil, or propane, it should be strongly considered that the University chooses to go in a greener direction.

Transportation

Jared Barrows, Avery Braccia, Claire Cavanagh, Courtney Conner, Mia Farley, Emma Karpinsky, Kelly McKenna, Liam Murphy, Samuel Richard, Marion Riddle, Patrick Voli

Creating sustainable transportation is a deeply important issue that pertains to our community and its surrounding environment. Salve Regina's campus is located on one of the most historic and beautiful landscapes in Rhode Island, and as a community, we work closely with local nonprofits such as the Newport Preservation Society to preserve the precious land we are fortunate to call ours. The efforts that have been made to preserve this land are important, and we are thankful to those individuals that work tirelessly to continue these efforts. However, there is an overarching environmental concern that we as an institution need to recognize in more depth and come up with plausible solutions to help.

Last April, Governor Dan McKee of Rhode Island signed into law the 2021 Act on Climate. This act states that the state will set mandatory and enforceable principles in order to achieve net-zero emissions economy wide by year 2050. The Transportation and Climate Initiative Program fundraising efforts will allow the state to invest nearly \$200 million between the years 2023 and 2032 to modernize transportation, improve public health, address environmental inequities in low-income communities, and protect residents from the impacts of climate change (RI.gov). One of the many concerns regarding climate change is vehicle pollution, the region's greatest source of greenhouse gasses. RI, MA, and CT governors have also signed a memorandum of understanding (MOU) which commits to reinvesting almost \$300 million each year across jurisdictions for cleaner transit, modern infrastructure, and healthier communities (Ri.gov).

Here at Salve we do our best to support the environment by sponsoring various volunteer opportunities throughout the school year. These are done through the Center for Community Engagement and Service. Salve also provides students with free public transportation, which is available through proof of one's student ID. Students can take the Newport trolley and Salve shuttle, which drive throughout the city of Newport. As Salve Regina University is a Mercy institution, taking care of the Earth is a top priority (Critical Concerns, n.d.). Other Catholic and Mercy institutions of higher education have implemented strategies in which to improve transportation systems that Salve Regina can learn from.

Methods

In researching the topic of the effect of transportation on the environment and ways to incorporate more sustainability into Salve Regina University's community, we have compiled various goals that can help us achieve this. Some of our specific goals include acquiring information from the trolleys and RIPTA system to learn how many Salve Regina students ride them, meeting with Safety and Security to learn how many students at Salve Regina have a car registered on or off campus, and finding out the average distance students and faculty members have to travel to reach the school. Ultimately, we hope to limit gasoline use and limit carbon emissions produced from vehicles.

Comparative Catholic/Mercy Schools:

University of Saint Joseph (West Hartford) - has partnered with Easton Coach Company and Suburban Transit Network to provide shuttle transportation service; East and West shuttle; any employee, faculty member, or student who drives a University-owned vehicle must go through a formal driver certification process (initiated by signing up for a Defensive Driver/Van Driver Training course)

Carlow University (Pittsburgh) - Full-time student parking permit = \$265; biking is a popular transportation method: students can rent a bike two blocks from campus through Healthy Ride Pittsburgh; students can ride the bus/T for \$1 after 7pm on the weekdays, and all day on the weekends, as long as they present their IDs and pay in cash.

Specific Goals/Objectives for this team

- Determine number and use of student cars on campus
- Estimate carbon emissions
- Obtain information on trolley/RIPTA lines near campus
- Find out where students are from/distance they need to travel to and from school

As evident by university parking passes (Table 1), that has gradually decreased over the last three years, there about 900 students parking on campus on a regular basis. This does not include students who might try to utilize street side city-controlled parking (Table 2), thus the total number of commuters is probably higher. Many of these may also be sophomore residents, thereby cars with stickers but those not used for daily commutes to class. In the most recent school year (2020-2021), there were 534 total commuter parking spots and only 415 commuters registered to receive parking passes. However in 2018/2019, there were 539 commuters registered. The commuter spots and city street parking (Table 2) fill quickly during the prime teaching hours and that might be a best index of daily commutes to campus to estimate a carbon footprint.

Commuting and parking are parts of the daily challenge for commuters coming to campus, limiting parking spots adds to student frustration but might be leveraged to encourage carpooling. Currently there are no incentives for students to have electric or hybrid vehicles, and there are no EV charging stations (Table 2).

Table 1. Annual Parking Decals Issued by Salve Regina University. Provided by Office of Safety and Security.

Year	Resident Decals	Commuter Decals	Total
2018-2019	416	539	955
2019-2020	447	451	898

2020-2021	439	415	854
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Table 2. Parking Lots and Parking Spaces on campus (2020-2022).

Lot Type	Number of Lots	Number of Spaces
Commuter	7	336
Resident	16	413
Street parking within campus boundaries	N/A	198
Electric Vehicle charging stations	0	0
Total	23	947

Nearly 25% of all undergraduates participate in Division III athletics. Commitment to their team requires a commitment to commuting to practice (Table 3). If a standard car gets 25 mpg and emits 20 lbs of CO₂ per gallon, each mile a student drives to practice adds 0.8 lbs of CO₂ to the atmosphere. To reduce the carbon footprint we need to have electric shuttles, encourage carpooling and encourage personal vehicles that are eclectic. Conference tournament travel increases the footprint for as long as we have vehicles running on fossil fuels (Table 4). Air travel can be offset with carbon credits (e.g., www.terrapass.com).

Table 3. Salve Regina University Athletic Department Information

Practice/Game Location	Teams	Distance from Salve (Miles)
Toppa Field	Men's soccer, Women's soccer, Football, & Cheerleading	1.0
St. George's Ice Rink	Men's ice hockey & Women's ice hockey	3.1
Gaudet Middle School	Women's lacrosse, Men's lacrosse, Field hockey, & Track/field	4.8

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Brenton State Park	Men & Women's Cross Country	1.8
Fort Adams State Park	Men & Women's Cross Country	3.4
Average		2.82 miles

Table 4. Conference Teams distances (one way) from Salve Regina, 2021-2022. Carbon emissions, one way based on diesel powered bus that gets 10 mpg

CCC Teams	Distance from Salve (Miles)	Carbon Emissions* (pounds)
Roger Williams University	13.7	27.4
Suffolk University	73.3	146.6
Curry College	63.1	126.2
Wentworth Institute of Technology	72.9	145.8
Endicott College	72.4	144.8
WNE University	115.8	231.6
Nichols College	65.3	130.6
Gordon College	110	220
Husson University	309.5	619
UNE	167.4	334.8
Long Distance	Spring break trips to Florida (Baseball, Softball) and Tennessee (Tennis)	

The information in table 3 and 4 represents the distance traveled by Athletic teams at Salve Regina. Gaudet Middle School is the furthest practice location from Salve (4.8 mi.), while Toppa Field is the closest (1.0 mi.; Table 3). Both Gaudet Middle School and Toppa Field have the same amount of teams that practice at them (4). There are many schools in the conference that are over sixty miles away, making the tournament commute rather long (Table 4). The far

distances increase the rate of carbon emissions released during the commute, a positive however is most of the teams take one bus to and from games.

Students attending Salve Regina University in 2021-2022 come from all over the country, and there is a sizable population of international students (Table 5). Throughout the school year, we have a lot of breaks that require students to go back home, resulting in constant travel. For some students, the drive to and from school can be as short as a few hours, but for others it could require a train or an airplane ride. All of this travel has resulted in a major increase in carbon emissions being released into the air.

Salve Regina University is posed with an inextricable problem of trying to draw students from as many locations as possible to diversify the campus, while simultaneously trying to meet the challenge of carbon neutrality. The campus could treat commuting to and from campus from home as an externality to the carbon calculations or own those credits in policy building and offsetting.

The University offers a one-time flight reimbursement program for admitted students from states outside of the Northeast, which could be purchased with a carbon offset third party corporation (e.g., www.terrapass.com). Closer to home, Salve Regina could provide EV charging stations for parents and reduced vehicle parking stickers for hybrid and EV passenger cars.

Table 5. Admissions Information, Salve Regina University 2021-2022

Region	# of enrolled students
United States	1988
MA	673
CT	450
RI	302
NY	177
NJ	140
NH	79
PA	22
ME	20
MD	17
FL	13
CA	12
VT	11
MI	8
VA	7
AZ	6
IL	6
MN	5
CO	4
WA	4
NC	4

WI	4
TX	3
HI	3
OH	2
GA	2
DE	2
SC	1
UT	1
IN	1
KY	1
MO	1
AK	1
WV	1
IA	1
OK	1
WY	1
OR	1
LA	1
Canada	17
Japan	6
Syria	3
United Kingdom	3
Germany	3
United Arab Emirates	2
El Salvador	2
Panama	2
Senegal	1
Hong Kong S.A.R.	1
Trinidad and Tobago	1
South Korea	1
Afghanistan	1
Spain	1
New Zealand	1
Philippines	1
Grand Total	2034

In May 2018, the State of Rhode Island stated that \$14.4 million of the state's Volkswagen settlement funds would be used to take important steps toward improving the air quality of Rhode Island including our community here at Salve. This includes the acquisition of electric buses for the Rhode Island Public Transit Authority. The state's plan calls for \$10 million to be used to replace old diesel buses that are being retired with new all-electric zero-emission vehicles.

RIPTA is splitting this project into two phases. First, it has launched a pilot program with three leased all-electric buses. This program, which includes the installation of charging infrastructure for the buses, is giving RIPTA a chance to learn about the new technology, train staff, and test the performance of the electric buses on a variety of RIPTA routes. Once the pilot program ends, RIPTA plans to purchase sixteen to twenty electric buses as permit additions to its fleet. This process began in 2021.

One of the more attainable options that Salve Regina has to lower transportation carbon emissions is to limit the use of private vehicles on campus. Some common substitutes for lack of private driving are carpooling, using public transport like the trolley, as well as walking. Another solution to the use of private vehicles is encouraging more spaces to be reserved for electric vehicles. The more spots for these vehicles the more encouraging it will be for students to either walk or consider public transport. The recent rise in gas prices will also help to encourage students and faculty to find other ways of getting to where they need to go. Walking is also a good substitute for typical transportation. A lot of students use the trolley to go to relatively close stores and shops. Places like Stop & Shop and CVS are only half a mile away from Salve Regina's campus; it is a fifteen-minute walk. Another method that should be utilized on campus is bikes. Salve Regina is a small campus so the need to get from one side to the other is not a great concern, however, if the students are encouraged to use bikes more for moving around Newport, instead of driving or using the trolley then the reliance on these carbon-emitting vehicles will go down. Another solution that is expected to make a large impact is the electric bus program that went into effect in 2021. RIPTA planned to introduce sixteen to twenty electric buses for public transport. All of these small changes are what we are able to do as a school and as a community. In order to change how things are done, we have to start replacing the old ways with the new ways. We cannot wait for everyone to decide whether or not they want to make these changes.

Food

Natalie Bryant, Mary Duman, Alex Gajic, Abby Hoye, Stella McCormack, Emma McGrillen, Mia Pastorok

Salve Regina University could significantly reduce carbon emissions by changing some aspects of food purchasing, production and consumption. One-quarter of the world's greenhouse gas emissions come from food production (Ritchie, 2020). The goal of our study was to find out where Salve Regina sourced our food, specifically if it came from ethical sources, and how much energy we are using on food production. Sodexo, the campus contractor for dining services, provided us with information regarding these questions. Also, we conducted a survey among a small sample size of students to gain a better understanding of an average student's eating habits at our dining hall. All of this information helped us to find solutions to increase sustainability in our dining facilities and decrease our carbon emissions.

Table 1. Current waste produced by Miley Dining Hall and average surplus can be improved.

Waste Produced and Recycled by Salve Regina's Food Services										
# of Totes		# of Gallons per Tote		Time		Gallons of Waste Per Academic Year		Weight of Food Waste Per Gallon		Every pound of food waste generates 3.8 pounds of greenhouse gas emissions
65	x	60	x	8 months	x	31,200	x	10 lbs	x	3.8
										=
										1,185,600

Salve Regina currently has robust methods to manage food waste from the dining hall. Food scraps are picked up by The Compost Plant. This helps to reduce our carbon footprint by utilizing their services as explained in their mission, *"To close the loop in the food system, turning food scraps and "waste" products into compost and soil mixes that help gardeners and farmers grow more local food. We believe more local food means healthier communities...and we believe it all starts with healthy soil"* (Compost Plant). The cooking oil we use is given to Newport Bio Diesel. The oil is recycled into biodiesel and converted into sustainable heating fuel. This helps to reduce our reliance on imported petroleum, providing a far cleaner form of energy. Waste in landfills converts to methane and "every pound of waste generates 3.8 pounds of greenhouse gas emissions" (Box, 2021). Salve Regina reduces the global warming potential of methane as none of our waste goes to landfills. Despite our productive composting efforts, the amount of waste produced by the dining hall can be reduced to bring our carbon footprint down. A solution to reduce waste production is to collect and analyze data based on current trends in dining hall attendance, average food habits, and the amount of waste collected from different food types. This data can inform future purchasing decisions, creating potential ways to streamline meal production that do not result in a surplus of food or waste materials.

Another contributor to our carbon emissions is the types of food we consume. Nearly 30% of our food is locally sourced, however studies show that another way to reduce carbon footprint is to

focus on what we eat over whether or not our food is local. Animal-based food has a higher CO₂ emission rate compared to plant-based food (Figure 1). Beef and dairy have a large carbon impact deriving from cows' methane emissions as well as emissions from farm machinery, fertilizers, and manure. The survey we conducted among Salve Regina students showed that only 20% of students were never willing to choose a vegetarian option in Miley Dining Hall (Figure 2). This lead us to the solution "Meatless Mondays", a program introduced in our dining hall that would omit beef meals for one day a week. Research conducted by Our World in Data has found that "going 'red meat and dairy-free' (not totally meat-free) one day per week would achieve the same as having a diet with *zero* food miles" (Ritchie, 2020). Strategically reducing beef used on campus could significantly decrease our carbon footprint by 2050 (Figure 3).

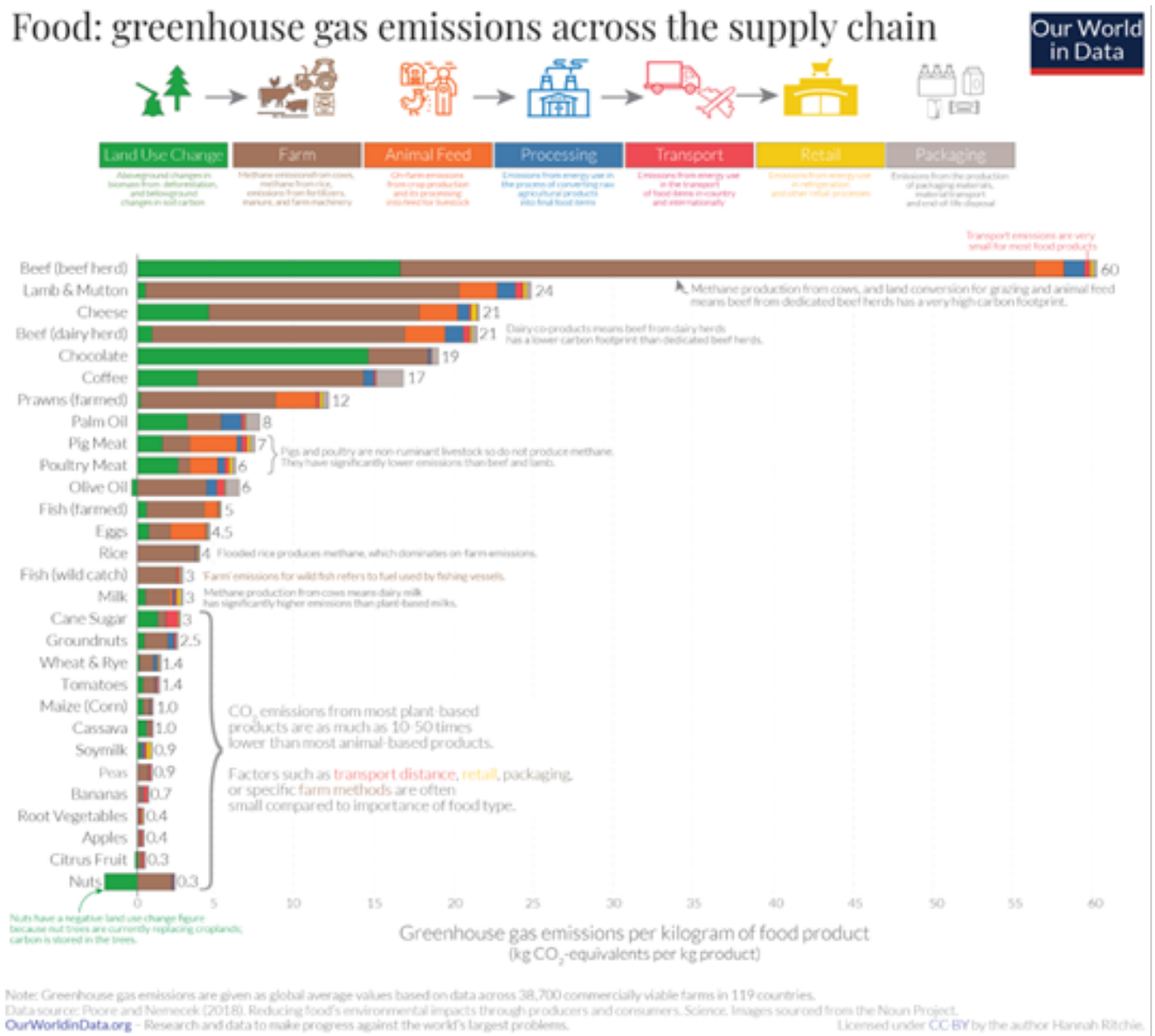


Figure 1. Greenhouse gas emissions across the food supply chain, Our World in Data 2022.

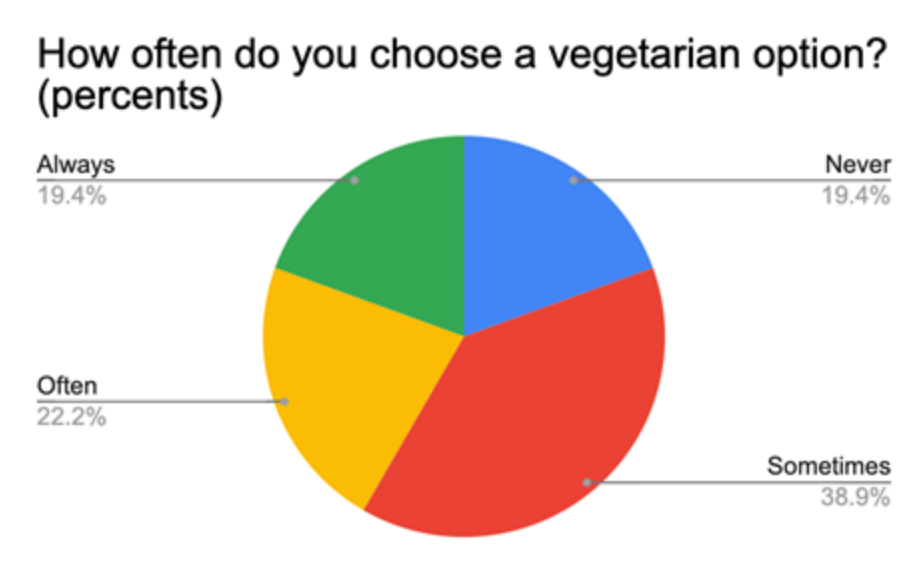


Figure 2. This pie chart represents the percentages of students who choose the vegetarian option at Miley Dining Hall. Sample size 41 undergraduate students.

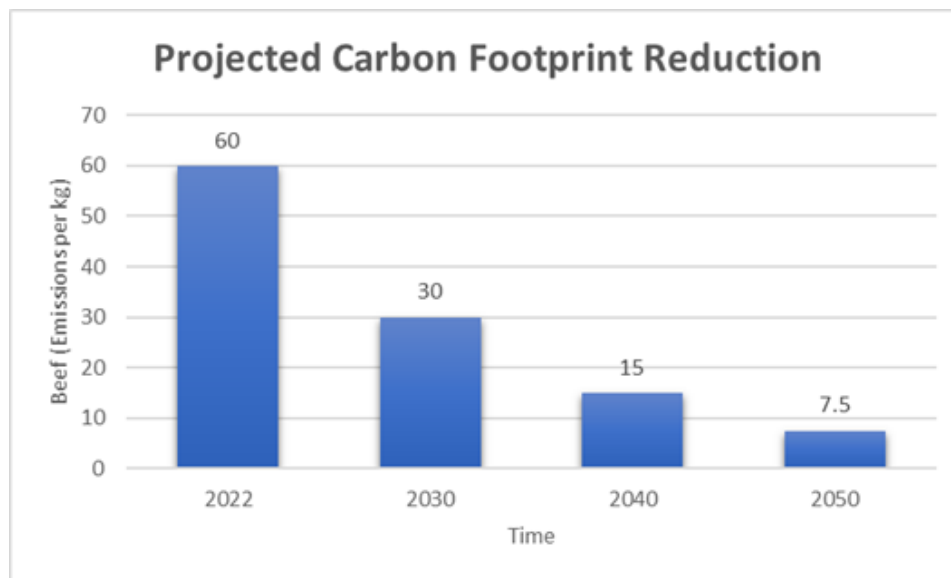


Figure 3. Projected Salve Regina University carbon footprint stepwise reduction by slowing eliminating beef in the Dining Hall diet plans.

Financial

Dylan Bigansky, John Deady, Andrew Hassler

Globally, a major goal recently has been trying to reduce our carbon emissions to as low as possible in an effort to counter climate warming and to keep our planet habitable for generations to come. One way that Rhode Island has done this is by signing on to make all carbon emissions zero within the state by 2050. In order for the State of Rhode Island to achieve this goal in a relatively short span of time, many forward thinking, carbon based direct and indirect changes have to occur. One carbon-based aspect that is often overlooked is the financial component of this carbon neutral challenge. Many businesses, schools, organizations and individuals all around the world utilize expendable capital to invest in hopes of turning a profit. While this critical component of the economy must continue, many businesses are choosing to invest in companies that are not climate-neutral and thereby invest and support carbon emissions into the atmosphere contributing to climate warming (IPCC 2018). Some of the most environmentally damaging industries are those that use the most fossil fuels, including transportation, industry, electrical generation and agriculture. While making sound and productive investments is critical for the success of the university and its students, we need to invest in businesses that are successfully adapting to low carbon future.

Salve Regina University currently invests in both companies that are green and those working towards going carbon neutral, but also others that are still contributing to climate change problem. Other Rhode Island institutions such as Brown University have already made the leap to make all their investments in companies that are carbon neutral and still generate a profit (Brown University). Salve Regina University was established by the Sisters of Mercy and we continue to follow their guidelines and ideals today. One of their five critical concerns currently is Earth (Critical Concerns, n.d.) and investing in companies that are not respecting our Earth is directly contradicting the Mercy Mission that our university was founded upon. By making the change to invest in only green companies we are keeping with the university mission of upholding the Sisters of Mercy's values but are also adapting to the new state mission and are setting the standard for how other institutions around the world should invest.

In order to combat climate change and reduce our university's carbon footprint in a push towards carbon neutrality, we will take a financial approach. After looking through the school's financials we found some areas that the school could improve on to make sure we are investing in green companies. Most of the school's equity funds are passively managed presently, with a large percentage in private equity and Alt funds (S. Sacco, pers. comm.). A challenge is the addressing the Board of Directors aggressive growth objectives for the university endowment. Beyond the endowment, another aspect of the school's financial infrastructure is providing the option to employees to invest their 403b TIAA/CREF retirement in a socially and environmentally friendly fund that will help not only grow their fund but through companies that are green (Salve Regina University: Investment Options). The employer contribution is currently 7% and an additional 1% is added if the faculty or staff invest at least 1%. The school's endowment of roughly \$90 million is relatively small compared to many other universities (Sam Sacco, pers. comm.) and makes arguing against purely growth-focused investment very difficult. While this will be challenging, there has also been immense growth in environmentally-friendly

sectors of the economy recently. Some of the most promising of these that certainly deserve consideration are electric vehicles.

As part of our research, we met with Professor Sam Sacco, who is a representative for the 403b employees are offered. He informed us that Salve Regina hires a company called BFA to organize a packet offering the different investment opportunities employees can choose to partake in. In this packet, each stock is analyzed based on risk, recent performance, and return. This system allows employees to base their investment choices on how much risk they want to assume, and what type of companies they want to put their money towards. There are nearly 100 options to choose from, giving a wide variety of stocks employees can add to their portfolio. As of next year, BFA will add a new portion of analytics to the packet. Currently, if an individual wants to invest in a certain stock, they can look at the packet they are given to understand its performance over the past few quarters as well as the risk entailed with the investment. If the employee is interested in the company itself, they must do their own research to find what they do/sell, and how they perform on an environmental scale. BFA will soon display how each stock ranks environmentally, allowing the investors to fully understand what they are putting their money towards.

Overall, after conducting research on the finances of Salve Regina University we have found that although they do offer a socially green investment option to their employees, the school itself does not invest in funds that are entirely carbon neutral. The school abides by the five core values set by the Sisters of Mercy and Earth is one of those values. To do our job as a school we must do everything we can to help the Earth and funding companies that are hurting it is a disservice to both our founders and our future. By investing our endowment in separate green funds we can help do our part in saving the Earth. Also, these funds can be very profitable and in some cases even more so than funds that are not green (Figure 1). The primary detractor from many green companies is that they are often relatively young and carry a higher risk than well-established, steady growing funds. It is a big decision to make as what we as a school invests in is very important, but other schools around the country have already started to make the switch and we can still be part of the movement to change college investments. There is still research to be done to identify more green but productive funds that the school could potentially switch to.

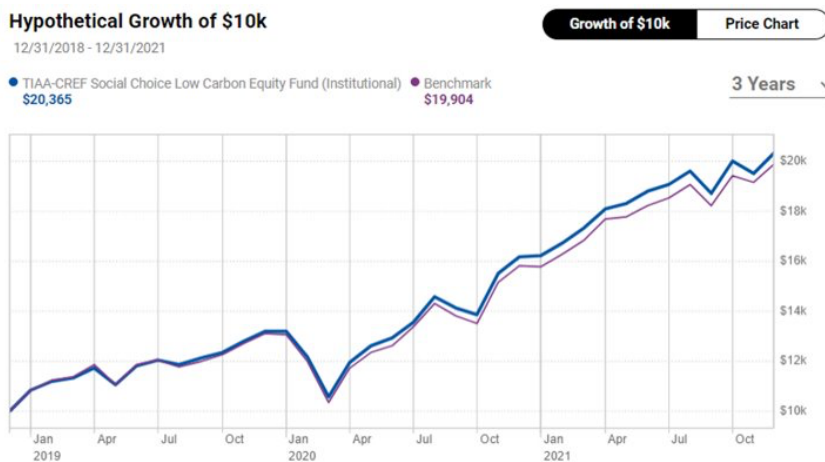


Figure 1. Potential growth of \$10,000 invested over three years in standard mutual fund and low carbon fund offered by TIAA/CREF.

However, the option to invest in a green retirement fund and the addition of carbon neutrality ratings to the school's portfolio are very intriguing and exciting developments we are happy our school is thinking about. Going carbon neutral by 2050 is the goal of our state and by making this change we will be helping the school's mission to accomplish this earlier, in order to protect our planet.

Sequestration

Casey Bermingham, Jerry Cheatham, Alexander Colon, Genevieve McClelland, Maggie McCue, Maeve Newton, Aidan Tucker

While our peers focus on the task of reducing Salve Regina's carbon emissions, there are realistic constraints on their actions. For this reason, sequestration is an important step when it comes to reaching net-zero carbon emissions. Sequestration, as simply defined by the United States Geological Survey, is the process of capturing and storing atmospheric carbon dioxide (United States Geological Survey). The earth does this naturally in several ways and it is our mission as sequestration advocates to protect and optimize our campus's natural ability to sequester. Throughout the Spring 2022 semester, we have worked towards that mission.

Our work began with researching tree and plant species with high sequestration abilities and could be introduced to Salve Regina before the end of the semester. From this research, we determined that planting a clover lawn on campus was an ideal option. Clover has the potential to sequester approximately three metric tons of carbon per acre per year making it up to 13% more effective at sequestration than a normal lawn which sequesters 0.5-1.5 metric tons of carbon per 2.2 acres per year (Fisher, 2018; Clark, 2020). With further research and communication with the groundskeeping crew at Salve Regina, we decided on planting Dutch white clover (*Trifolium repens*) on the approximately 2-acre lawn surrounding Rodgers Recreation Center before April 30th, 2022. To cover the entirety of the grassy portions of the property, six 10-pound bags of clover seed were added as cover seed (Figure 1) with the goal of increasing the total amount of carbon sequestered on campus by six metric tons per year.

In order to pursue larger sequestration projects in the future, the Sequestration Group researched the trees on campus and the amount of carbon they sequester to aid in the decision of trees that can be planted going forward. Our calculations (Mora Lab) have revealed that the 1,463 tagged trees on the Salve Regina campus have sequestered approximately 4,749 metric tons of carbon as of January 2022. From here, we plan to establish the tradition of planting a tree for each incoming class to increase awareness of the importance of natural forms of sequestration and Salve Regina's role in meeting the goals of the Act on Climate bill.



Figure 1. April 2022 clover overseeding, Salve Regina University

Recommendations

To reach Carbon Neutrality by 2050, starting immediately we should:

- (Energy) Begin renovations on buildings across campus to improve efficiency.
- (Transportation) Provide incentives for registering electric vehicles for parking passes and have at least five charging stations and parking spots designated for them.
- (Sequestration) Plant clover to overseed 20 acres and add at least one significant new tree per year while replacing any older trees that are taken down.
- (Food) Collect and analyze data based on current trends in dining hall attendance, food habits, and food waste types.
- (Food) Establish a “Meatless Monday” in the dining hall.
- (Financial) Work with Prime Bucholz to move away from fossil fuel holdings.

To reach Carbon Neutrality by 2050, and to reach 80% below 1990 levels by 2040, we need to start planning now to implement the following practices:

- (Energy) Move away from natural gas to a cleaner alternative energy source and complete renovations for improved hot water and HVAC systems.
- (Transportation) Have at least ten parking spots and charging stations designated for electric vehicles and utilization transportation with (a hopefully advancing) RIPTA electric bus system and Salve Regina’s bike rental program.
- (Transportation) By 2040 all university vehicles and shuttles are electric.
- (Sequestration) Set a maintenance and monitoring plan to support trees on campus.
- (Food) Establish an optional “go green” “Meatless Monday, Wednesday and Friday” in the dining hall; reduced dining hall meal plans for Climate Friendly Dining.
- (Financial) Research and begin investing in the energy sector of the economy.

If Carbon Neutrality can be reached by 2050 the most challenging aspects of campus life that we need to address now and plan carefully between now and 2050 are:

- (Energy) Solar-powered lights illuminate outdoor spaces and many indoor spaces
- (Transportation) All university vehicles and most faculty and staff vehicles are electric and there are ample charging stations. Bike rental program is twice as large as 2030 to meet the demand, RIPTA buses are electric and well used by students, faculty and staff.
- (Sequestration) Purchase land off campus to ensure net-zero emissions. This land will be protected and cared for to ensure optimal sequestering of CO₂.
- (Food) Establish a school community garden from which dining hall food can be sourced. Most food is locally sourced, meat diet is smaller and mostly locally sourced lower carbon chicken and fish.
- (Financial) Green mutual fund established, TIAA/CREF contributions by Salve Regina and the endowment is climate neutral certified.

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