Climate Action Plan
& Sustainability Guide

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Prepared for Pacific Lutheran University

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For The Pacific Lutheran University

This Climate Action Plan & Sustainability Guide is a collaborative effort, combining the engineering analysis experience of McKinstry and the university level sustainability knowledge of the Pacific Lutheran University facilities management and sustainability personnel. The team created this holistic plan founded on reduction of carbon emissions, increased energy efficiency and the human and cultural aspects of creating a truly sustainable campus.

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Pacific Lutheran University

EXECUTIVE SUMMARY

This plan describes the current sustainability programs and initiatives on the PLU campus while creating vision for future improvement opportunities. It includes an evaluation of carbon mitigation strategies at the facility level to help PLU better understand the savings potential and investment needed to obtain a carbon neutral footprint by 2020. Through the combination of these measures, PLU hopes this plan will drive initiatives to ensure that climate protection and sustainability are actively incorporated into every aspect of the institution, supporting their mission: seeking to "educate students for lives of thoughtful inquiry, service, leadership and care - for other persons, for the community and for the earth."

CAMPUS EMISSIONS

Reporting greenhouse gas emissions from the university is a critical step in planning for a sustainable campus and is a requirement for the signatories of the American College & University President Climate Commitment (ACUPCC). For this report, the baseline 2008 PLU greenhouse gas inventory (GHG) was calculated using the Clean Air Cool Planet Campus Carbon Calculator. Defining carbon emissions requires detailed data collection. This report addresses a baseline emission level for PLU based upon the best available data from the campus. This report also addresses strategies and systems that need to be implemented on the PLU campus for future tracking to provide accurate reports and verifiable reductions made. Criteria for these emissions are based on the ACUPCC definition of the different sources of emissions.

- Scope 1 emissions account for direct GHG emissions from sources the institution owns and controls.
- Scope 2 emission accounts for indirect GHG emissions from the generation of purchased electricity consumed by equipment or operations owned or controlled by the institution.
- Scope 3 emissions account for indirect GHG emissions from all other sources that occur as a consequence of the institution's activities but are not owned or operated by the institution.

1. **GHG Inventory Results**
    a. Data Collection

Data for the 2008 GHG inventory was collected from a variety of sources from on-campus tracking, departmental records, previously reported values from other reporting documents, and surveys. Not all data required for a complete inventory calculation was available for the PLU campus for this report. The reporting team discussed how to approach these data gaps, and it was concluded that for data not currently tracked by PLU (student air miles in particular), it would be more accurate to extrapolate from data reported from other universities rather than simply omit values altogether. With these extrapolations in mind, the carbon footprint used as a baseline in this report is likely to change as PLU integrates accurate tracking and consistent reporting in the future.

Commute Transportation - Faculty and staff transportation and commute data from the preliminary 2009 Washington State Department of Transportation (WASHDOT) Commute Trip Reduction (CTR) survey. The team had access to results from both the 2007 and preliminary 2009 CTR results but used the 2009 values for this 2008 baseline due to the higher response rate, therefore indicating a more accurate sampling of the faculty and staff commuter profiles. Student commute data was provided by a 2008 student commuting survey that was used in reporting for STARS.

Air Travel – Travel records were compiled from reimbursement request, credit card purchases and travel reports. Faculty/staff air travel values were taken from values reported in the 2008 STARS report. Since no tracking of student air miles currently exists at PLU, per-student averages reported from other ACUPCC signatory universities were used to estimate the total student air miles (from study abroad and athletics travel).

b. Future Improvements

Through the process of collecting, compiling and reporting the 2008 GHG Inventory, gaps in current data collection processes were identified, and strategies for improvement were designed. Although much of the data was available, the current system at PLU does not have centralized purchasing, and this makes accurate data compilation extremely labor intensive. PLU should make streamlining data collection a priority for future GHG inventories.

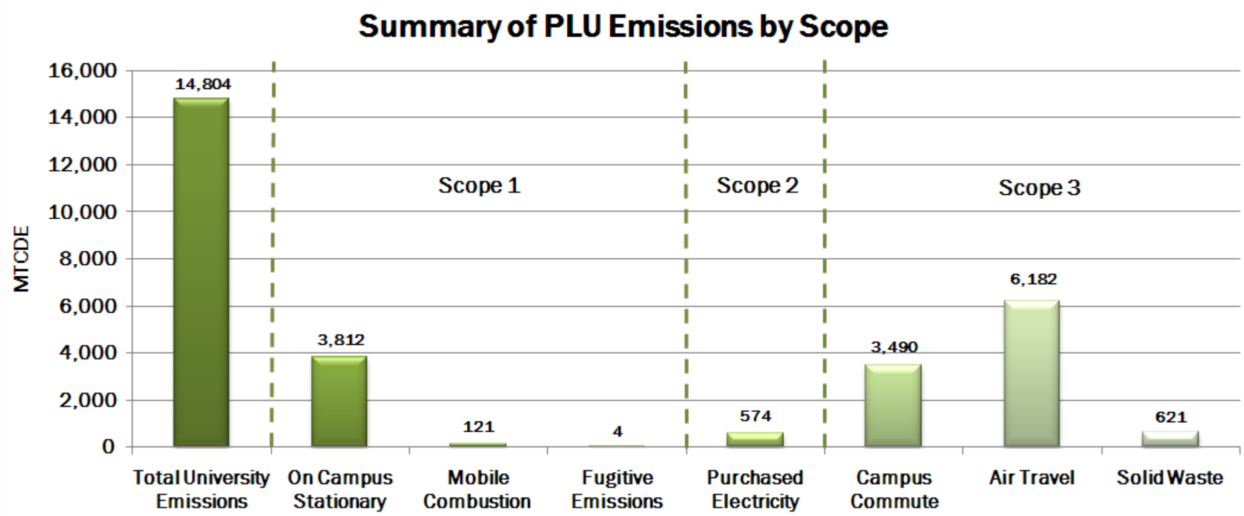
By implementing structure to streamline data collection throughout the campus will make future inventories less labor intensive and more accurate. The most critical improvements need to be addressed in accurate data collection for air travel miles and commute transportation patterns. By developing tracking mechanisms and new survey approaches will help PLU more accurately capture PLU's total carbon footprint.

c. Benchmark Values

The 2008 GHG Inventory for PLU was based upon the most accurate campus specific data available, and where data did not exist, estimates were used to benchmark the university's carbon footprint. Data for Scope 1 and Scope 2 were typically available for the university, but Scope 3 data, specifically in reference to student air travel, was based upon estimates from other ACUPCC universities reported data. For all reduction calculations in this report this benchmark will be used.

Emission Scope	MTCDE
Scope 1	3,937
Scope 2	574
Scope 3*	10,293
Scope 1+2+3	14,804
Offsets	-36
Net CO2e Emissions	**14,768**

*Note that Scope 3 emissions are based on other ACUPCC institution estimates for air miles, and are therefore are likely to change in future GHG Inventory reports as PLU fine-tunes its data collection methods to accurately represent the campus.



The baseline Metric Tonnes Carbon Dioxide Equivalent (MTCDE) for the PLU campus is approximately 15,000 MTCDE/yr, including Scope 1, 2, and 3 metrics. Understanding where emissions are coming from will help PLU focus reduction goals and track their progress as they reduce emissions across all three scopes.

Approximately 574 MTCDE (13% of Scope 1 and 2, 4% of total) is associated with purchased electricity use, 3,821 MTCDE is from campus fossil fuel use (85% of Scope 1 and 2, 26% of total). Facility improvement measures identified in Part 7 of this report give PLU guidance on how to mitigate some of the Scope 1 and 2 emissions. Emissions from Scope 2 are extremely low due to the school's location allowing for the use of hydroelectricity. While this gives PLU a unique advantage to reaching carbon neutrality, it also puts concern on monitoring Parkland Light and Water's fuel mix for any changes that may affect the University's carbon footprint.

Scope 3 emissions are primarily sourced from air travel (60% of Scope 3, 42% of total), campus commuting (34% of Scope 3, 24% of total), and solid waste (6% of Scope 3, 4% of total). The carbon amount listed for air travel is an estimate based on averages of similar sized schools. PLU realized the need for a more controlled way to track air travel miles in the future. Part 5 and 6 of this report expand upon current strategies and future goals for implementation of Scope 3 emissions reductions on campus.

2. Reduction Goals

PLU's goal is to be carbon neutral by December 31, 2020. PLU's highest priority is to reduce to carbon by direct action on campus. Priorities are listed in order of conservation, improvement to facilities and purchasing offsets after all other options have been exhausted.

3. Key Performance Indicators

Through the strategies outlined in this report, PLU has the potential to dramatically reduce its carbon emissions. To track the progress and impact of these efforts, they will annually report their carbon footprint using campus data. It is recommended that PLU continue to use the most current version of the Clean Air Cool Planet Campus Carbon Calculator to maintain consistency in reported values to show accurate reductions achieved. This document will undergo campus wide review and will be updated accordingly.

Background on PLU

Pacific Lutheran University has a tradition of progressive "thinking green" and serving as an institutional role model for sustainability measures in the Pacific Northwest. Commitment to the education and well being of their students, focus on being a positive asset to the community, awareness and action towards safe and efficient facilities are all steps that PLU has taken, which set the stage for a sustainable campus. This plan is an initial step for PLU to show its commitment to reducing the university's environmental impact and empowering its students to become environmentally responsible global citizens.

PLU is basing its approach to sustainability on the 1987 United Nations Brundtland Commission Report definition: "sustainability is meeting the needs of today without compromising the ability of future generations to meet their own needs." The PLU community is working with this definition to incorporate specific university values, goals and initiatives, and aims to turn the campus into a living laboratory, demonstrating integrated sustainability of specific tactics to embody the university's ever-evolving goals.

In recent years, climate change has become an issue of not only environmental importance, but serious economic and social significance as well. Scientists and politicians have documented the consequences of neglecting our environmental responsibilities and have issued a call to arms to combat global climate change. Research shows that, if unmitigated, our global behavior will lead to unprecedented climate changes that are likely to lead to premature melting of ice caps and snow, rising sea levels, and an increase in extreme weather events that have the potential cause increased flooding, drought, destruction of costal ecosystems and shortages of fresh water. These changes present consequences for ecological stability, human health, productivity and lifestyle.

The goal of this report is to capture current sustainability initiatives on campus, create a comprehensive approach that will lead PLU towards multi-faceted sustainability. It includes specific strategies related to campus culture, curriculum, current emissions, transportation, waste stream, facility efficiency improvements and renewable energy technology.

Commitment to Sustainability

PLU has a long history of being committed to a sustainable campus and leading the way as an example for institutions around the world. A certification program in environmental studies was developed in the 1970's, and a major was established in the 1990"s. On April 22, 2004 President Loren Anderson signed the Talloires Declaration, making PLU the first Pacific Northwest University to sign the declaration. Drafted in 1990 at an international conference in Talloires, France, this is the first official statement made by university administrators of a commitment to environmental sustainability in higher education. The Talloires Declaration (TD) is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities. It has been signed by over 350 university presidents and chancellors in over 40 countries.

Leading the nation as an early signatory to the American College and University Presidents Climate Commitment (ACUPCC) in 2007, PLU accepted the challenge, showing commitment to achieving carbon neutrality. The agreement calls for universities to reduce greenhouse gas emissions, but PLU has taken the initiative to set their goal of becoming carbon neutral by December 31, 2020. The success of reaching carbon neutrality will require commitment to timelines and goals, strategic funding, engineering support to help facilitate physical modification decisions, and enthusiasm and cooperation from all students, faculty, staff and supporters of the Pacific Lutheran community. It is a large, but attainable, goal, and by reaching it, PLU will serve as a model institution of sustainability.

PLU is a founding member of the Association for the Advancement of Sustainability in Higher Education (AASHE). In 2009, AASHE released the pilot version for Sustainability Tracking, Assessment & Rating System (STARS), of which PLU was a part. For 2010, AASHE is releasing STARS 1.0. STARS was designed as a tool for collaboration both on campus and benchmarking with other campuses, rating universities on a scale of bronze, silver, gold and platinum levels. PLU is striving to achieve recognition as a platinum institution.

PLU has garnered a prestigious ranking in 2009, as the Sustainable Endowments Institute released its College Sustainability Report Card for 2010. Overall, the university was graded an A-, with A's granted in many areas such as climate change, energy use, student involvement and food and recycling. PLU was one of only 26 colleges or universities to receive an overall A- mark, the highest grade rewarded this year by the institute.

To continue increasing awareness, implementing programs and tracking their progress, PLU has created this Climate Action Plan and Sustainability Guide addressing the approach they plan to take for integration on campus. The scope includes a report of current initiatives, potential improvements and key performance indicators that PLU will use to track the progress on campus. The following initiatives bring attention to the largest factors of campus sustainability, and through the action steps recommended, the PLU campus will be actively progressing towards a sustainable, carbon neutral campus, and serving as a model for campuses around the country.

PART 1: SUSTAINABILITY IN CAMPUS CULTURE

PLU is working to establish seamless integration of sustainability into campus culture, so that it becomes habitual for students, faculty, and staff. Members of the PLU community take pride in the green initiatives that the university has undertaken over the years, and has earned them recognition as a leader in both the Pacific Northwest and the United States.

1. Sustainability Culture at PLU

Students at PLU recognize and value of their connection to their university's environmental impact. In spring 2007, PLU students requested that $20 per student per year be set aside for purchase of green energy and energy conservation projects on campus. This student-led initiative shows there is interest in developing these types of programs, and the initiatives, programs, and strategies outlined in this report will help drive their implementation schedule and visibility.

Even with this well established pride, PLU has great potential for increased sustainability awareness in lifestyle choices, transportation, waste, and utilities use that will rispire positive impacts across the campus. Student ideas, sustainability projects, facility upgrades and education all present opportunities for PLU to take the next steps and truly integrate sustainability into the campus.

2. How Sustainability is Managed

Sustainability on the PLU campus is being approached from many areas. Through this blend of lenses, PLU hopes to create a collaborative team to brainstorm ideas and implement projects that will reach all departments, faculty, staff and students. Although "thinking green" has been present on campus for many years, specific management and involvement with sustainability has historically been decentralized and undocumented. Signing the ACUPCC required PLU to establish a central team, spawning the development of the University Sustainability Committee; a collaborative campus group formed to inspire, promote, and celebrate sustainability. The committee includes members representing a diversity of departments on campus with the intention of integrating ideas that will benefit the PLU community as a whole. For a complete list of committee members please visit: http://www.plu.edu/sustainability/

While it makes most sense for sustainability initiatives to be housed in the specific department they most affect, it is also vital to have a central hub aware of and maintaining progress of all efforts. The University Sustainability Resource Coordinator is tasked with providing organizational support to existing sustainability initiatives in order to guarantee their success. By having a dedicated Office of Sustainability, PLU is able to organize, synchronize and prioritize sustainability projects and planning. It also allows the office to identify opportunities for further efforts, which will be both assigned to other departments, and performed directly by the Office of Sustainability.

In order for the Office of Sustainability to grow to meet these tasks several resources should be available in house. Resources such as dedicated time from the Office of Development, access to graphic design capabilities, and use of student staff members are a few examples. The exact nature of what will be required is a question currently being considered by the PLU 2020 Planning Committee.

3. Sustainability Initiatives on Campus

PLU has a variety of programs that are being implemented on campus to incorporate sustainability into daily culture and routine. PLU is taking initiative to dramatically increase sustainability awareness and education on campus. The following are a sample of the programs implemented on the PLU campus. Details about specific programs will be expanded upon later in the report.

- UnPLUg: This initiative began as an electricity reduction competition between residence halls with the focus of educating students to reduce phantom loads on electronic equipment, turn off lights, and reduce electricity consumption in their rooms. Winning halls were awarded SmartStrips: power strips that cut power to devices that do not need to be on 24/7.
- Student Fellowships have resulted in projects like Take Back the Tap, Bring Back the Bike, and native habitat restoration
- Annual participation in RecycleMania
- Garfield Commons as a practice in smart growth, linking campus culture with the community
- LEED Certified buildings, such as Neeb, University Center and Morken Hall
- Integrated Pest Management Plan
- SurPLUs
- Center for Public Service
- Can the Can
- Carpool benefits and bus pass subsidies
- Purchase of environmentally preferred power for all LEED buildings and residence halls

4. Future Goals

PLU hopes to incorporate sustainability into the daily culture and lifestyle of students, faculty, and staff on campus. To create programs that will inspire sustainability measures throughout all aspects of campus culture, curriculum and day-to-day living, ongoing program development, it will be necessary to insure continuing funding and dedicated individuals to develop these programs.

5. Key Performance Indicators

PLU will track its incorporation of new sustainability programs through the expansion of the Sustainability Committee annual updates, the progress of the Sustainability Resource Coordinator, and participation in student led initiatives. The University administration will develop comprehensive strategies and campaigns to improve campus sustainability and reduce our carbon footprint.

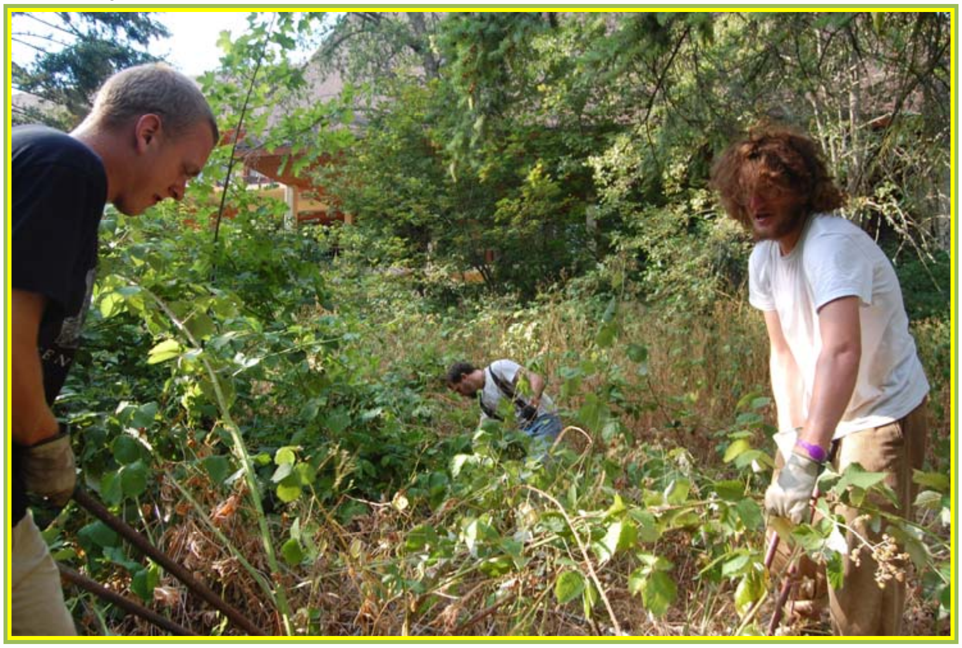
PART 2: CAMPUS OPERATIONS

Sustainability of a place is intimately tied to the physical site and associated developments. For PLU to fully integrate sustainable practices, understanding the connections between university practices and decisions and the physical site must be made a priority. The 126-acre PLU campus impacts a large area in the Parkland community. Its size and openness contributes significantly as an open space within the urban neighborhood, and PLU recognizes its opportunity to develop this open space as an ecological refuge. On a regional scale, the campus falls within the Clover Creek/Steilacoom Watershed. The water within this watershed flows into the Clover Creek drainage basin and discharges into Lake Steilacoom, eventually discharging into the Puget Sound. PLU has taken the initiative to work on mitigating its environmental impacts on campus and positively affect the surrounding area. By understanding the local ecology, watershed, climate, PLU will be more prepared to integrate measures of sustainability that will have a broad environmental impact on both the local and regional environment.

Over the past 100 years, the PLU campus has developed a specific character and style. Most buildings are predominantly brick, or have brick elements. Tall fir trees provide a beautiful canopy and deciduous trees soften the environment. While some walkways form a grid, most are more organic and follow the most used paths between buildings. New plantings of trees and shrubs will expand the highly valued character of upper campus to the lower campus.

1. **Natural Resources**

The natural environment serves as a life supporting system for people, wildlife and plants in many ways. The natural systems enrich habitat and biodiversity; maintain natural landscape processes; cleans the air and water; increases recreational and transportation opportunities; helps improve our health; and provides us with better connections to nature and a sense of place. Protecting these resources is an ongoing challenge in today's society where we face issues of sprawl, water quality, endangered species, etc., and requires consideration of the natural environment as a system, linking parks and other green spaces for the benefit of people and biodiversity.



The university is striving to reestablish habitat and increase biodiversity that has been pushed out of the Parkland area. Current initiatives include a grant funded restoration of both aquatic and terrestrial habitat through the Urban Habitat Restoration Project. This project seeks to establish a native habitat/educational area on the PLU campus. They will use students and volunteers from the community to remove invasive species and establish native plants to enhance the site as a corridor to connect habitat in the surrounding Clover Creek watershed.

2. **Grounds Keeping**

The 2006 Campus Master Plan established recommendations for maintaining an aesthetically pleasing, environmentally sensitive, and functional campus landscape. A large, vegetated campus requires high amounts of grounds maintenance and the approach PLU chooses to use for grounds keeping dramatically impacts the local environment. To reduce these impacts, PLU grounds keeping strategy includes diverse, native plantings, focusing on landscapes with low-irrigation requirements, and minimal chemical application.
One innovative strategy that the campus has approached the control of invasive blackberry plants is to collaborate with a local goat herder and use his flock to control the hillside instead of chemical application or physical removal which would have increased erosion.

3. **Water Quality and Conservation**

Located in Western Washington, PLU experiences high amounts of annual rainfall, which translates into environmental impacts from storm water runoff. The 2006 Campus Master Plan addressed water use reduction goals of 20% by 2011, largely through installation of new plumbing and careful consideration of landscape irrigation requirements. This plan also made recommendations for Low-Impact Design techniques for future storm water conveyance and infiltration systems, as well as future water quality treatment required on for new buildings.

Water Sustainability Workshops were the first initiatives on the PLU campus to drive education, generate interest and campus commitment to water reduction goals. These workshops focused on small and large group discussions for planning, as well as field trips for participants to better understand local water issues. Spanning these workshops over three years allowed PLU to include new participants each year, which brought new ideas to the table and provided enthusiasm for increasing awareness about campus water conservation initiatives that shaped water reduction goals in place today.

4. **Organic Waste and Local Food**

PLU's Dining & Culinary Services implements high standards in sustainability throughout the department. Their focus educates students and guests to recycle plastics, glass, aluminum and paper. The composting program at PLU has reduced an unprecedented amount of food waste from trays and the kitchen (over 70,000 gallons in 2008). PLU saw a reduction in dining waste to the landfill by over 65%. In the upcoming years, Dining Services will be working closely with residence halls to expand their compost programs.

The PLU Community Garden is a completely student, faculty and community run vegetable garden dedicated to providing fresh, local produce to members of the Parkland community. Currently the Garden donates nearly two tons of carrots, tomatoes, lettuce, broccoli, squash, onions, kale, and many other varieties of vegetables and herbs to the Trinity Lutheran Church Food Pantry. As well, the Garden provides the PLU Dining and Culinary Services with hand-picked local herbs for use in the University Center. In addition to the herbs, the PLU culinary team buys local produce and grass fed beef to enhance the flavor, freshness and nutrition offered to the PLU student customers while benefiting the local community and reducing food transportation.

5. **Mitigation for the Built Environment**

In 2006, the university completed its campus master plan, setting major goals with respect to sustainability. The university's commitment to sustainability naturally aligns with its mission and is reflected in its planning, policies, operations and maintenance practices and approaches. From the development of the campus master plan, the way in which it constructs, renovates or retrofits buildings directly correlates to these sustainability goals.

The design teams of all major building projects must demonstrate a thorough understanding of existing systems including circulation patterns, open space contribution, existing vegetation, and continuity with the physical context before developing design solutions. Building plans need to demonstrate how the project contributes to and supports existing systems and campus goals for green infrastructure, energy and water flow. Some of the highlights from the 2006 Campus Master Plan include provisions for new/remodel buildings including material durability requirements, retaining of open spaces, use of a similar color palate to the original campus, low maintenance and operating costs, and LEED certification with a goal of LEED Silver in new construction. The campus hopes to begin certifying existing campus buildings under LEED-EBOM Certification. For a full list of building design requirements see the 2006 Campus Master Plan.

6. Key Performance Indicators

PLU plans to include continued enhancements of these programs. PLU will establish involvement maintenance is involved in Tree Campus USA, the university branch of Tree City USA. This collaborative approach to grounds keeping will provide a metric for PLU's sustainable approach to their land use. PLU will continue standardization of water faucets and fixtures to increase water efficiency. PLU will continue to develop other metrics to track campus operations sustainability.

Part 3: Sustainability in Curriculum

PLU has initiated the process of defining the incorporation of sustainability in the curriculum. This is a complex process given the intrinsic multidisciplinary dimensions that comprise sustainability as part of the pedagogy of any university. There has not been any effort to date to comprehensively identify sustainability related courses at PLU due to this difficulty of defining sustainability as a discipline, or perhaps more precisely, defining how sustainability related learning objectives exist in the disciplines of PLU's existing curriculum. The process of defining these elements of sustainability in the curriculum has been started.

PLU is in the process of defining a PLU 2020 vision. One of the study groups that comprises this university wide undertaking is the group with the charge of defining PLU as a "Sustainable Community". This group will work this year with the entire university community to identify key questions, and to gather associated background material, that will allow a definition of sustainability in the PLU curriculum to emerge. This activity will be complete by June 2010. The following year will complete this process with appropriate decisions and implementation of the definitions. This will allow PLU to establish a baseline measurement of sustainability related courses by the end of the 2010-2011 academic year.

1. Methods of Current Implementation

PLU has an existing academic major and minor in Environmental Studies. All of the courses that comprise the major and minor requirements for these two courses of study will presumable agree with whatever the outcome of the curricular definition of sustainability. Details for these courses and their content can be found at the Environmental Studies Program homepage on the PLU website. It is understood by the broad university community that there are many other courses at PLU that will also be defined as sustainability related once a clear definition for this categorization is established.

2. Potential to Expand Programs

PLU recognizes that learning occurs both inside and outside the classroom. Understanding this opportunity to reach students opens many possibilities to approach the subject of sustainability integration. Designing projects and campus initiatives to turn PLU into a living lab that teaches its vision both inside and outside the classroom will provide students with a comprehensive education that ingrains sustainability as a lifestyle and value from simply being surrounded by it at PLU.

3. Key Performance Indicators

A mechanism to identify and report the inclusion of a sustainability focus in the curriculum will be established with the PLU faculty. This will occur after the university and its faculty agrees to an appropriate interdisciplinary definition of sustainability. The target for this baseline measurement will be the completion of the 2010-2011 academic year.

Part 4: Reducing Scope 3 Emissions - Transportation

Transportation for faculty, staff and students impacts many aspects of the university campus, including considerations to physical layout, safety, emissions and financial decisions. In addition to daily commuting, the university sustainability plan addresses issues related to air travel and the university fleet. When combined, these transportation measures will provide more sustainable options for the PLU faculty, staff and students, reduce emissions, and increase connectivity to the campus and surrounding Parkland community.

1. Transportation Choices

   a. Current Situation

Based on the preliminary 2009 Commute Trip Reduction survey results, 71.4% of faculty and staff drive alone for their daily commute. Many students require less commuting as 51% of undergrads live on campus, however 49% of students still cite single occupancy vehicle (SOV) trips as their primary form of transportation (STARS data 2007). This shows that there is significant room for reduction of SOV trips for students, faculty and staff. By decreasing reliance on SOV travel, PLU will greatly reduce its carbon footprint, increase air quality, and reduce parking issues on campus.

Biking is a growing part of student culture at PLU. The campus is bike-friendly, with large flat areas to ride, bike racks for storage, and student interest in increasing ridership. Students are initiating Bring Back the Bike: a program that includes added bikes on campus, funding the current bike co-op and safety measures to serve PLU students. This program has the potential to greatly alter student choices in their daily transportation.

In addition, the University subsidizes bus passes for all employees and students and commit to using mass transit at least three days a week. The University also provides reserved carpool parking spaces. Electric vehicle charging accommodations are available in two parking lots on campus.

   b. Alternative Options

The Parkland area has a well established public transportation system in place, and has a park-and-ride transfer station near the PLU campus to facilitate the use of this service. Bus passes are subsidized for faculty and staff, making this a more feasible commute option.

To further reduce emissions from commuters, it is recommended that PLU expand on current programs, as well as implement new ones. Potential strategies for reducing commuter emissions include:

- Offer more online courses
- Increase parking fees
- Restrict parking passes to upper classmen
- Explore areas in need of bike paths

- Make on-campus housing attractive to minimize off-campus living
- Subsidize near campus housing for faculty and staff
- Education about the campus carbon footprint goals and the impact of individual commute choices
- Convert parking lots to green space

c. Strategies to Increase Use of Alternatives

Understanding the transportation habits, needs and choices of the PLU community is an important first step in addressing how to increase the use of public transportation. More comprehensive student surveys to understand what is driving transportation choices, education about alternative options, carpooling incentives, and establishment of new programs such as Bring Back the Bike will decrease reliance on the SOV. The addition of a bus pass subsidy for students would also decrease the reliance that students have on SOV trips.

2. Air Travel

a. Impacts

Air travel is necessary for faculty and students to take full advantage of academic and educational opportunities. Faculties require air travel for conferences, presentations, meetings and educational workshops. Students require air travel for athletic teams and study abroad opportunities. PLU is proud to emphasize the importance of study abroad, and encourages that all undergraduates take advantage of this unique educational experience. The emphasis on travel increases the carbon footprint and environmental impact due to air travel; something that PLU is working hard to mitigate.

b. Strategies for reduction

Air travel reductions are challenging because many programs are viewed as beneficial and valuable as part of the college experience. Student air travel is calculated from air miles from for-credit study abroad programs and athletics; both value additions to the educational experience at PLU. To reduce air miles for study abroad activities, the university could look at having students purchase offsets for their trips or encourage destinations nearer to the Sea-Tac airport. Athletics needs to be aware of their carbon footprint and develop strategies to mitigate that carbon. PLU athletics will collaborate with NCAA as they work to reduce carbon footprint. Air travel from faculty and staff could be reduced by PLU continuing to improve campus technologies that make telecommuting to conferences more attractive and feasible.

3. University Fleet

PLU Facilities Management has a plan to reduce the impacts from the daily transportation needs to service the campus. Efforts have been made to replace older fleet vehicles with more fuel efficient models. In 2009, PLU Facilities added Prius and Scion cars to their fleet, replacing older 15-passenger vans. There is a standing goal of all campus vehicles being electric.
For on-campus use, electric utility carts and vehicles have been purchased to reduce emissions.

4. Key Performance Indicators

To track progress in reducing reliance on SOV use, PLU will complete bi-annual transportation and parking surveys to track commuter trends and parking lot usage patterns. Education will focus on the reduction of SOV travel.

To track air travel, PLU will establish framework for air travel tracking for the university by 2011. This data collection will facilitate future GHG inventories with accurate PLU data. Education for faculty and staff about the importance of reducing air travel by prioritizing trips will also be a priority.

To replace older vehicles in the PLU fleet, vehicles with higher efficiency, hybrid or electric will be selected. The fleet inventory will progressively become less reliant on fossil fuel.

PART 5: WASTE STREAM MANAGEMENT

Understanding the university's waste stream is critical in addressing the sustainability of the PLU campus. Waste stream takes into account purchasing decisions, including packaging, waste production on campus, methods of waste disposal, effectiveness of alternative disposal programs (recycling, composting), and reuse through the campus SurPLUs program. The PLU waste stream is carefully monitored by the facilities Environmental Services staff. To minimize waste sent to the landfill, careful attention is paid to the accurate sorting of recyclables, diversion of compost and reuse of university goods.

1. Waste Disposal Practices

   a. Waste disposal

PLU Environmental Services has worked diligently to reduce waste generated at PLU, and responsibly manage the disposal and deferral methods in place. Environmental Services focuses on waste stream reduction by educating the campus about alternatives and best practices for waste diversion by recycling, composting or reusing their products.

These programs are working. PLU estimates that its current diversion is 60-70% of the waste stream, and is dedicated to working towards a zero waste campus. Education to the campus is playing a large role in the success of these programs. Environmental Services has distributed questionnaires across campus in the past to gauge levels of understanding and receive feedback from the faculty and staff for improvements.
In 2006 the "Can the Can" program was introduced to faculty and staff to encourage conscious decisions on waste disposal method. Voluntary participants receive a miniature garbage can in replacement of the standard garbage can. Through the removal of the standard can, individuals are responsible for accurately recycling items, consciously throwing away as little as possible (with the help of the miniature waste can), and emptying out their individual Can the Can.

b. Recycling program

The recycling program at PLU provides a pathway for used goods to be diverted from landfills. Students have access to recycling bins in residence halls and in common areas throughout campus. Employees have desk side recycling bins for paper and access to common bins for other recyclable goods. The recyclables are all manually sorted before they leave campus to ensure quality control. Measures include removal of hard plastic bottle caps, correct sorting and removal of non-recyclables. This extra effort ensures that PLU is able to recycle all loads they send, rather than have them rejected and sent to the landfill for poor quality.

PLU encourages the incorporation of recycling at PLU special events. Planning for special events recycling allows PLU guests to continue their recycling habits and help PLU maintain and improve its waste diversion rates and reduction goals. Environmental Services provides guidance on effective planning for these events on the website.

Recycling of hazardous materials is facilitated by Environmental Services. Each residence hall is provided with bins to collect spent batteries, and these are collected and recycled along with light tubes and rechargeable batteries (including cell phone batteries) in the PLU hazardous waste disposal program. By providing students with a convenient disposal site, PLU hopes to encourage student to refrain from simply throwing away spent batteries.

Future improvements in the recycling program include increased participation, recycling receptacles in classrooms, and identifying more potential for diversion. Participation is increasing due to education efforts, and these will continue to expand. Awareness about the recycling is included in freshman orientation and this has already greatly increased participation. Environmental Services is working on the logistics of placing recycling containers in PLU classrooms. PLU tried putting cans in a few pilot classrooms, but the cans caused disruption when removal schedules interrupted classes. By coordinating these schedules, PLU could dramatically increase its recycling participation. PLU will continue to examine the opportunities to increase the convenience of recycling on campus.

Environmental Services is also working to identify markets/destinations for materials that are not currently accepted through their recycling provider. It is recommended that PLU consider moving to co-mingled recycling to reduce the labor required for the current sorted recyclables program.

c. Composting program

PLU began its composting program with lawn waste from grounds keeping. More recently it has grown to include compost from coffee grounds and food waste at break stations for faculty and staff around campus. Dining services has its own branch of the composting program which diverts all food waste from the kitchen and diners from the garbage, and allows paper and waxed or greasy pizza boxes and other paper items with food contamination to be composted with their program. This has also given PLU a way to divert a large volume of organics that would otherwise be in a landfill.

PLU hopes to expand the composting programs, and is using feedback from the university to approach expansion in effective ways. Complaints about odors and fruit flies have been addressed through the purchase of new sample bins. Once the most effective bins have been selected, their placement around campus should continue to increase participation in the compost program.

d. SurPLUs

To divert used durable goods from landfills, PLU Environmental Services now runs SurPLUs, a campus store that collects and re-sells old inventory. The inventory includes used goods such as office supplies, file cabinets, desks, chairs, shelves, TVs, tables, and electronics. This program provides many benefits to the PLU community, including reduced excess inventory and storage requirements, reduced volumes of waste disposal, saves money from purchasing re-used goods, and generates additional revenue for the campus.

e. Move Out

At the end of the academic year, students leaving campus can have a large impact on the waste stream. PLU has started the comprehensive Move Out program to reduce the volume of usable goods throw away. Each residence hall receives boxes labeled for non-perishable food, clothing, personal care items, and University Center (UC) dishes. Collected items are distributed to local shelters, low income community groups, the food bank, and dishes are returned to the UC. This program greatly reduces the volume of items thrown away and benefits the local community.

2. Procurement

a. Current Practices

PLU does not currently have a centralized purchasing system, however large contracts are reviewed and signed by the Office of Finance and Operations. These contracts are screened to insure utilization of best practices. The current procedure allows individuals and departments to meet their own procurement needs without reporting though a single point. This has advantages and disadvantages for the university. Advantages include freedom for faculty and staff to purchase what they need and select the products they desire. Disadvantages include increased difficulty in tracking purchases, less visibility in procurement patterns, and reduced opportunity for suggesting sustainable product selections. PLU is expanding its procurement guidelines to include Energy Star rated appliances and equipment, as well as EPEAT computers.

b. Improvement Strategies

By offering a selection of sustainable “preferred” office products, through Corporate Express, PLU faculty and staff would be able to select sustainable options for daily supplies like paper. All correspondence that involves capital equipment purchases will provide the Energy Star and EPEAT web site for easier reference for all purchasers.

3. Key Performance Indicators

PLU will continue to explore strategies for effective waste stream reduction from procurement to disposal. Waste stream audits will show progress and reveal areas for improvement with future changes to the current practices.

PART 6: REDUCING SCOPE 1 & 2 EMISSIONS - FACILITY IMPROVEMENTS

1. Methods of Evaluation

McKinstry conducted an on-site analysis of 12 buildings on the PLU campus as part of the facility assessment for the Climate Action Plan. The purpose of this analysis was to evaluate carbon mitigation strategies at the facility level to help PLU better understand the facilities savings potential and investment needed to assist in obtaining a carbon neutral footprint. The team collected information first hand during energy audits gathered utility data to calculate the current emissions and energy use baselines. McKinstry identified implementable reduction measures and calculated savings potential and investment required to implement the measures. These measures were then grouped into four interventions herein called "Mitigation Scenarios". These mitigation scenarios will be implemented alongside behavioral carbon reduction programs on campus.

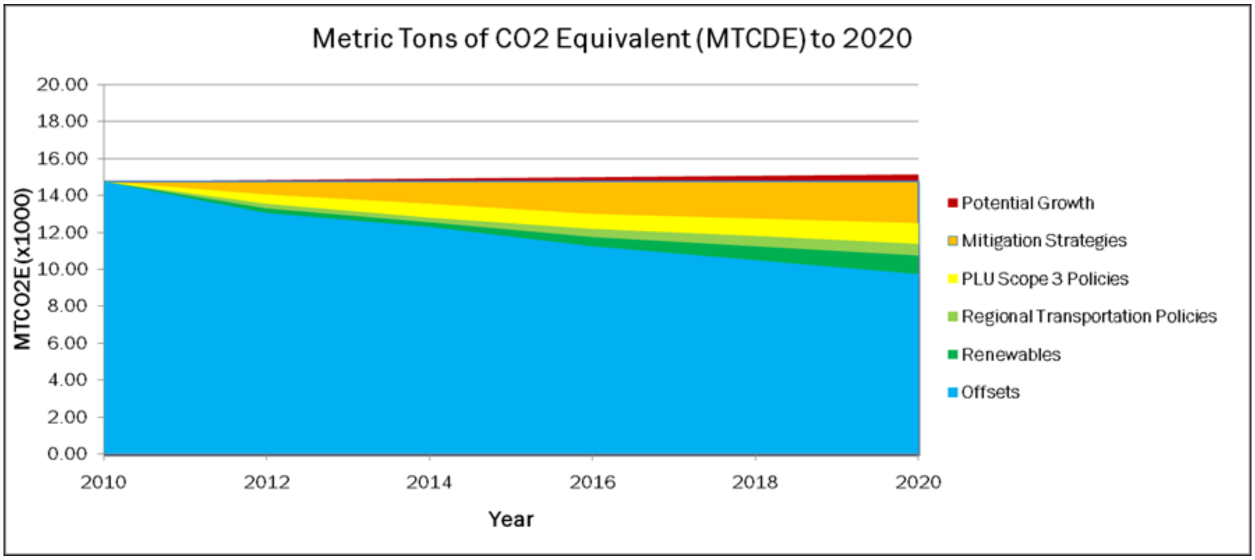
a. Carbon Emissions to 2020

The results of this analysis are summarized in the carbon stabilization wedge graph below. The wedge graph is a useful tool in understanding and assessing the options for mitigating carbon emissions. Each wedge represents a different practice, technology, or policy that affects the carbon footprint of PLU. The goal of a stabilization analysis is to show how each wedge varies over time, thus helping the university make informed decisions about its carbon footprint reduction strategy.

The uppermost wedge of the graph represents the effect of business as usual growth on the PLU carbon footprint. Below this, the Mitigation Strategies wedge shows the effect of implementing facility improvement measures. The bulk of these measures are shown occurring over the first ten years, with a small improvement over time as improving technology allows for additional facility improvements. The next two wedges of the graph represent estimated saving from changes in PLU and regional transportation policies. The renewable wedge of the graph shows an increasing amount of renewable technologies being implemented on the campus over time. Initial projects that PLU is pursuing include photo voltaic, solar thermal. A geothermal project to reduce the campus' dependence natural gas will further reduce its carbon footprint. This coincides with a decreasing amount of purchased carbon offsets, represented in the final wedge. Carbon credits and renewable technologies are closely related, as the current high cost of renewables and the current low cost of carbon offsets are expected to change. It is expected that the cost of renewables will drop significantly as technology improves, and the cost of offsets will increase with demand.

Pacific Lutheran University (PLU has launched a plan to invest $6 million to install a cost-effective, energy efficient and innovative Geothermal Heat Plant Project that will serve Eastvold Hall (the performing arts center in the heart of the campus) and five residence halls: Hong, Hinderlie, Kriedler, Stuen and Ordal. Once complete, the project will save about $200,000 in annual heating/cooling operating costs, and will use geothermal energy instead of carbon dioxide producing natural gas as a fuel source. McKinstry, a construction firm in Seattle, Washington estimates 52 jobs representing approximately $1.8 million in new money in the Greater Puget Sound region will be created or maintained to design and construct this project.

The project could be "rolled out" over a period of three years, particularly during the summer months when the students are not in the residence halls and when the weather is more conducive to construction projects. The university is prepared to provide a cost-match for this project but is not able to fully fund.



b. Mitigation Scenarios

This strategic facility plan quantifies the estimated cost and savings associated with the four intervention scenarios that, if implemented, will help PLU meet its goal of carbon neutrality by 2020. It is important to note that this analysis is considered a Rough Order of Magnitude study and therefore is not investment grade. Several assumptions were made regarding hours of operation, implementation logistics, and utility use where sub metering data was not available, etc. For a list of assumptions see the Assumptions Page located in the Appendix Section 3.

- **Mitigation Strategy 1** - Scenario demonstrates the impact of low- or no-cost projects on carbon emission and energy use reduction strategies.
  - Includes retro-commissioning and savings resulting from operations consolidated to reduce run times during partial use periods, i.e., weekends and summertime.
  - As campus culture becomes habitualized toward sustainability further cost savings will be realized.

- **Mitigation Strategy2** - Scenario involves significantly reducing carbon emissions with conservation projects that require capital investment.
  - Includes implementation of energy conservation measures such as controls, variable frequency drives, lighting retrofits, new equipment, etc. Measures were selected primarily for carbon savings, although some consideration was given to econometrics.

- **Mitigation Strategy 3** - Scenario includes the implementation of Renewable Technology, (discussed in Part 7) Geothermal Technology distributive generation. PLU has implemented Geothermal (ground source) Technology and is currently investigating the application of photo voltaic to mitigate carbon emissions. Given the temperate climate in the Northwest a distributive systems are most beneficial.

- **Mitigation Scenario 4 -** Carbon Neutrality will be difficult to achieve solely using energy efficiency and renewable projects, therefore, we have added a fourth level for a truly carbon-neutral campus. Carbon Neutral involves purchasing offsets to mitigate any excess carbon that cannot be reduced by implementing other projects.
    - Includes the amount of off-sets required to reach carbon neutral. This value is equal to the remaining emissions after the implementation of Mitigation Scenarios 1 – 3.

2. Individual Building Analysis Results

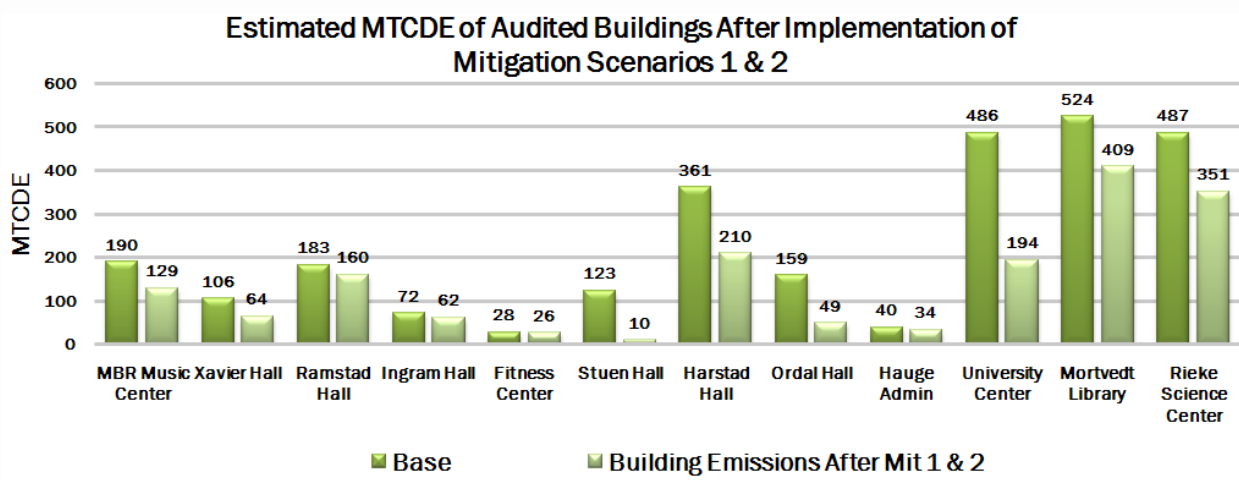
McKinstry's analysis includes surveys from 12 buildings on the PLU campus, which fed data for seven representative building categories. For the scope of this report, data from the seven buildings surveyed was extrapolated across the PLU facilities within the similar category to estimate potential carbon saving opportunities. Buildings surveyed included administration, residential, athletic, student center, library and academic buildings. The majority of the PLU campus is academic buildings and residential space, so four academic buildings and three residence halls were surveyed to give a more accurate sample. Utility data analysis was performed on all 12 surveyed buildings. A summary of each building's utility use is included in the Appendix Section 1.

Buildings Surveyed

Buildings	Building Use	Square Footage
MBR Music Center	Academic	33,714
Xavier Hall	Academic	20,318
Ramstad Hall	Academic	34,931
Ingram Hall	Academic	33,135
Hauge Admin	Administrative	62,259
Names Fitness Center	Athletics	5,500
Mortvedt Library	Library	97,438
Rieke Science Center	Research/Science	88,973
Ordal Hall	Residential	40,311
Stuen Hall	Residential	31,342
Harstad Hall	Residential	72,213
University Center	Student Union	87,787

Summary Findings by Building

Building	Annual Therms Savings	Annual kWh Savings	Annual Utility Savings	Annual MTCDE Savings
MBR Music Center	10,185	222,480	$23,327	61
Xavier Hall	7,574	49,320	$10,649	42
Ramstad Hall	4,126	22,887	$6,369	23
Ingram Hall	1,313	78,203	$5,058	10
Fitness Center	0	49,824	$747	2
Stuen Hall	21,515	-19,244	$22,254	113
Harstad Hall	28,423	6,781	$14,740	151
Ordal Hall	20,945	-12,460	$20,357	110
Hauge Admin	0	177,741	$2,666	6
University Center	51,430	596,928	$39,829	292
Mortvedt Library	15,388	999,084	$24,405	115
Rieke Science Center	23,058	424,039	$20,638	136

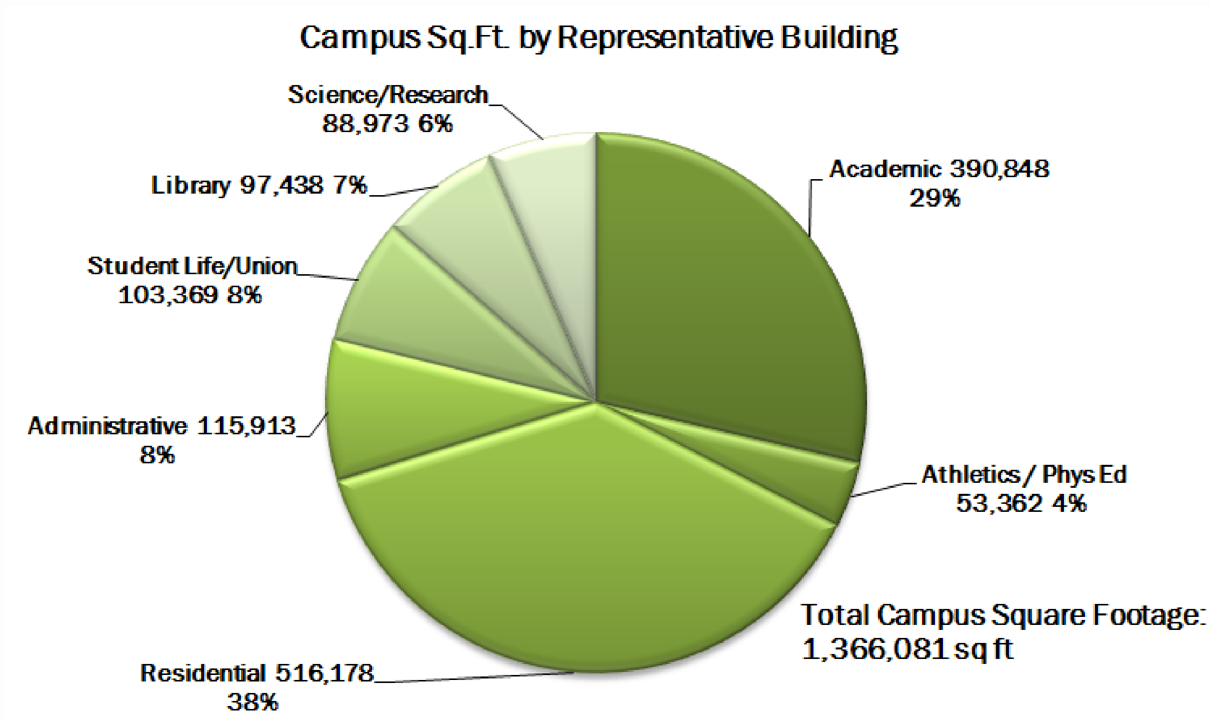


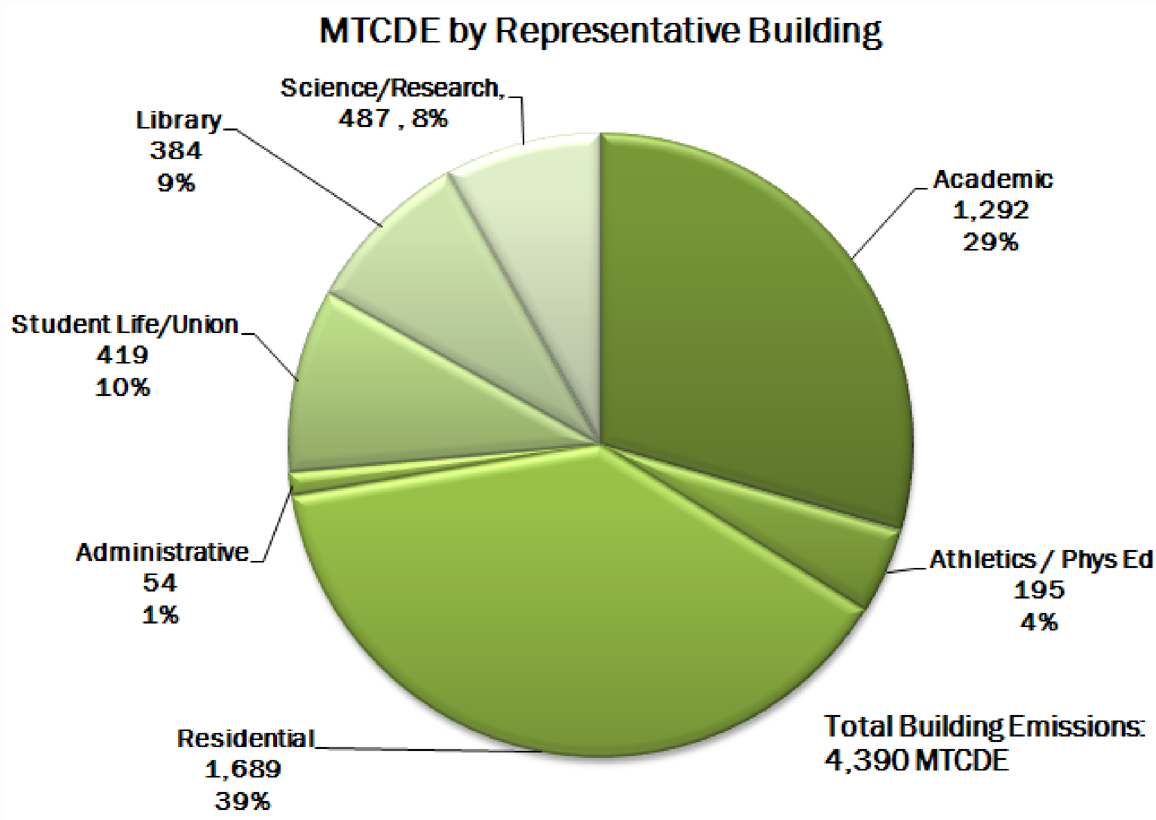
3. Representative Buildings Explanation

Representative building categories were established to consolidate building area by occupancy type. For the purpose of this report we assume that the building characteristics and project potential are similar for all buildings in each of the representative building categories. Using the results from the on-site analysis, we calculated the cost and savings by square foot, then by proxy, and extrapolated those values across the total building area of each proxy category on campus.

Buildings Categories

Categories	Building Gross Square Footage
Academic	390,848
Athletics / Phys Ed	53,362
Residential	516,178
Administrative	115,913
Student Life/Union	103,369
Library	97,438
Science/Research	88,973
Campus Total	**1,366,081**





4. Representative Buildings Analysis Findings

The following table outlines the baseline MTCDE for each of the representative building categories, and the estimated reduction after implementing Mitigation Scenarios 1 & 2.

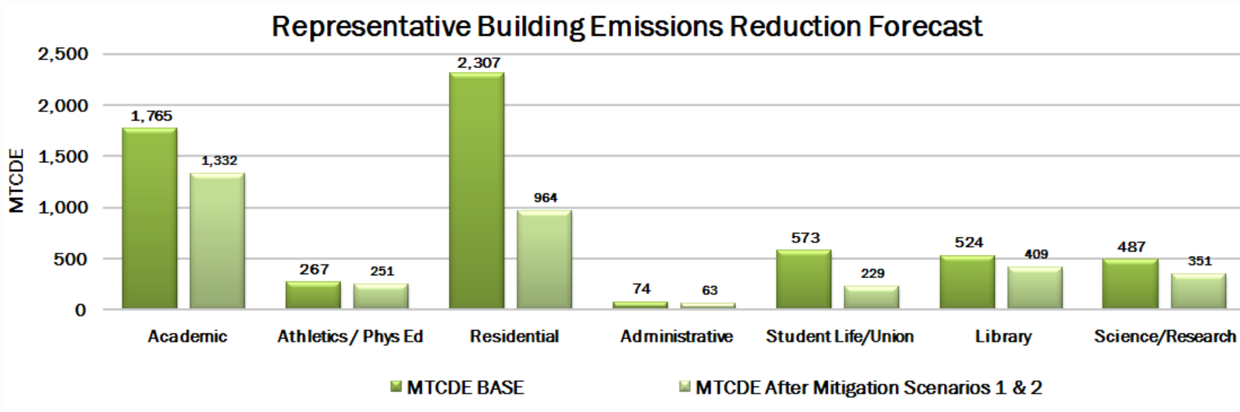
Potential Savings by Building

Representative Building	MTCDE BASE	MTCDE Savings from Mitigation Scenario 1 & 2	MTCDE After Mitigation Scenario 1 & 2	% MTCDE Reduction After Mit 1 & 2
Academic	1,765	433	1,332	24.5
Athletics / Phys Ed	267	16	251	6.0
Residential	2,307	1,343	964	58.2
Administrative	74	11	63	14.9
Student Life/Union	573	344	229	60.0
Library	524	115	409	21.9

Science/Research	487	136	351	27.9

* Savings are estimates based only. Some savings may vary depending on the accuracy of the assumptions made to complete the analysis.

The chart below illustrates the baseline MTCDE for each represented building, and the estimated savings for that PLU could achieve through implementation of Mitigation Scenarios 1 and 2.



Mitigation Scenarios 1 and 2

The carbon savings from implementing these facility improvement projects is estimated to be 1,785 MTCDE/yr. If the cost of a CO2 off-set is $7/MT, it would cost the university $12,495 to off-set the same amount of carbon without the positive benefits of new equipment and increased occupant comfort.

Various project opportunities exist in retro-commissioning of existing systems, installation of variable frequency drives on pump and fan motors where there currently are none, miscellaneous lighting retrofits of the remaining T-12's and incandescent lamps, and select envelope improvements.

Tightening operation schedules and consolidating facility operations during intermittent occupancy can also generate savings at the campus. PLU is currently developing a temperature set program, and seasonal arrangements should be implemented. The following pages contain facility improvement measure (FIM) tables showing a preliminary list of projects identified for increased energy efficiency and carbon savings in PLU buildings.

The projects identified are rough order of magnitude (ROM) estimates. They are based on estimated savings and costs, therefore and detailed budget studies should be conducted before any individual project is pursued by PLU. Budgets for these projects are likely to change, and could be significantly lowered with the assistance of incentive and rebate programs. Due to the unknown availability of these rebates and incentives when PLU will implement these projects, all FIMs ROM budgets are provided without these incentives.

FIM Table: University Center

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	CCF Sewer/ Water	Total Annual Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
UC	1.01-UC	Replace both boilers with (2) 2000 MBH high efficiency condensing boilers and review the distribution piping and heating coil and replace if needed.	23,083	0	0	$26,417	$299,779	11.3	122.2
UC	3.01-UC	Replace existing AHU fan motors with premium efficiency motors and add VFDs and modulate the fan speeds based on space temperature or return temperature. Note: Careful attention to building pressurization will be required in the development of this FIM. (1) 25hp, (2) 20hp, (2) 15hp, (2) 5hp, (2) 3hp, (2) 2hp and (3) 1hp.	9,695	206,105	0	$17,810	$297,741	16.7	58.2
UC	3.02-UC	Retrofit the CV system to VAV system. Total of 7 AHU's with about 120 fan powered VAV's with HW reheat. The scope includes re-arrange the duct and HW piping to VAV's.	11,634	305,516	0	$24,668	$1,250,913	50.7	71.7
UC	1.02-UC	Replace the existing condensate pump package. (1) duplex condensate pump package with 10hp each.	608	0	54	$1,187	$18,843	15.9	3.2
UC	3.03-UC	Extend the kitchen exhaust up higher (about 10') so that the building outside air intake will not be contaminated by the kitchen exhaust. Total of 4 EF's.	0	0	0	$0	$52,290		0.0
UC	4.01-UC	Provide a supply duct CO2 sensor for main AHU's - this sensor will detect "unused" return air and modulate the outside air damper accordingly. Total of 7 supply air CO2 sensor kits.	4,854	9,728	0	$5,847	$33,600	5.7	26.0
UC	25.01-UC	Perform retro-commissioning on the major mechanical systems. The scope includes performing P2P and Functional Performance Tests on major mechanical equipment.	7,271	141,904	0	$12,578	$52,673	4.2	43.2
TOTAL			**57,144**	**663,253**	**54**	**$88,508**	**$2,005,840**		

FIM Table: MBR Music Center

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	CCF Sewer/ Water	Total Annual Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
MBR	3.01-MBR	Install VFD's on the SF and RF and modulate the fan speed based on the duct static pressure. Install VFD on HW and CHW pumps and modulate the pump speed based on the differential pressure. (AHU-1: 15hp SF, 7.5hp RF; AHU-2: 10hp SF, 10hp RF; AHU-3: 30hp SF, 15hp RF; AHU-4: 5hp SF, 3hp RF; (2) 7.5hp HW pumps,(2) 10hp CHW pump) Install (2) differential pressure sensors for HW and CHW loop and install (1) static pressure sensor for each AHU.	0	92,500	0	$3,869	$142,561	36.8	3.1
MBR	4.01-MBR	Provide a supply duct CO2 sensor for main AHU's - this sensor will detect "unused" return air and modulate the outside air damper accordingly. Total of (4) supply air CO2 sensor kits.	3,557	7,638	0	$4,300	$24,960	5.8	19.1
MBR	18.01-MBR	Upgrade the toilets to 1.28 gpf model, urinals to 1/8gpf and install 0.5 gpm aerators on faucets. (4 urinals, 14 toilets, 10 faucets)	217	0	280	$2,518	$23,093	9.2	1.1
MBR	9.02-MBR	Install photo sensors for day lighting control. (10 occ sensors and 5 photo sensors)	0	20,345	0	$610	$7,110	11.6	0.7
MBR	9.01-MBR	Replace existing tungsten halogen flood lights with LED flood lights (about 24 fixture with 130 lamps and 500W/lamp)	0	79,950	0	$4,586	$49,896	10.9	2.6
MBR	25.01-MBR	Perform retro-commissioning on the major mechanical systems. The scope includes performing P2P and Functional Performance Tests on major mechanical equipment.	3,043	32,000	0	$4,442	$26,296	5.9	17.2
MBR	4.02-MBR	Implement CHW temperature reset, AHU DAT reset, AHU static pressure reset and boiler HW temperature reset. Total of 4 AHU's.	4,500	14,767	0	$5,593	$11,250	2.0	24.3
TOTAL			**11,316**	**247,200**	**280**	**$25,919**	**$285,166**		

FIM Table: Ordal Hall

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	Sewer/ Water Savings	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Ordal Hall	9.01-ORD	Upgrade the T-12 fixtures with magnetic ballasts to T-8 lamps with electronic ballasts. (25 T-12 fixtures and 64 lamps)	0	6,728	0	$257	$3,240	12.6	0.2
Ordal Hall	9.02-ORD	Install occupancy sensors for lighting control. (assume total of 25 occ sensor switches)	0	12,376	0	$371	$5,153	13.9	0.4
Ordal Hall	12.01-ORD	Install dedicated electric heat pump domestic hot water heaters to replace the existing East and North storage tanks. Shut off the main boilers to save on standby and distribution energy loss. (Install Qty of 9 Stiebel-Eltron Accelera heat pump DHW heaters in the attic space)	9,600	-49,224	0	$8,411	$215,902	25.7	49.2
Ordal Hall	18.01-ORD	Upgrade the toiler to 1.28 gpf model, urinals to 1/8 gpf and install 0.5 gpm aerators on faucets. (36 toilets and 36 faucets)	370	0	306	$3,165	$91,378	28.9	2.0
Ordal Hall	16.01-ORD	Install (2) vendingmisers on the vending machines.	0	5,200	0	$156	$1,162	7.4	0.2
Ordal Hall	13.02-ORD	Add insulation in the attic spaces. (17,000 SF R-38 batt insulation in the attic)	18,653	0	0	$19,213	$58,787	3.1	98.7
Ordal Hall	13.03-ORD	Install weather stripping to the exterior windows and doors. Seal the roof/ wall intersection. (870 ft of wall/ roof intersection, 60 bay windows (3.5'x5' + 5'x5' + 3/5'x5'), 36 7'x5' windows, 45 7'x4' windows and 60 3'x3' windows and 7 exterior single doors)	10,400	0	0	$10,712	$203,387	19.0	55.1
Ordal Hall	4.01-ORD	Upgrade the control system to Direct Digital Control system. (170 radiators, 8 EF's, 2 HX for DHW with 2 circ pumps each, 1 AHU with htg coil and 1 circ pump	2,867	0	0	$2,953	$455,100	154.1	15.2
TOTAL			**41,890**	**-24,921**	**306**	**$45,238**	**$1,034,107**		

FIM Table: Stuen Hall

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	CCF Savings Sewer/ Water	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Stuen Hall	9.02-STU	Install occupancy sensors for lighting control. (assume total of 15 occ sensor switches)	0	7,413	0	$222	$3,092	13.9	0.2
Stuen Hall	12.01-STU	Install dedicated electric heat pump domestic hot water heaters to replace the existing East and North storage tanks. Shut off the main boilers to save on standby and distribution energy loss. (Install Qty of 6 Stiebel-Eltron Accelera heat pump DHW heaters in the attic space)	10,800	-55,377	0	$9,463	$143,935	15.2	55.3
Stuen Hall	18.01-STU	Upgrade the toilets to 1.28 gpf model, urinals to 1/8 gpf and install 0.5 gpm aerators on faucets. (24 toilets and 26 faucets)	197	0	164	$1,694	$61,157	36.1	1.0
Stuen Hall	16.01-STU	Install (2) vendingmisers on the vending machines.	0	5,200	0	$156	$1,162	7.4	0.2
Stuen Hall	13.02-STU	Add insulation in the attic spaces. (9,500 SF R-38 batt insulation in the attic)	10,424	0	0	$10,737	$52,665	4.9	55.2
Stuen Hall	13.03-STU	Install weather stripping to the exterior windows and doors. Seal the roof/wall intersection. (560 ft of wall/roof intersection, 38 bay windows (3.5'x5' + 5'x5' + 3/5'x5'), 30 7'x5' windows, 45 7'x4' windows and 60 3'x3' windows, 4 exterior single doors)	7,983	0	0	$8,222	$170,610	20.7	42.3
Stuen Hall	4.01-STU	Upgrade the control system to Direct Digital Control system. (114 radiators, 2 HW boilers with 3 pumps, 4 EF's, 2 HX for DHW with 1 circ pump each, 1 AHU with htg coil and 1 circ pump)	2,229	0	0	$2,296	$334,560	145.7	11.8
Stuen Hall	1.01-STU	Replace both boilers with (3) 2,000 MBH each new ultra high efficiency Hydrotherm KN20 condensing boilers.	16,178	0	0	$16,663	$398,006	23.9	85.6
TOTAL			**47,811**	**-42,764**	**164**	**$49,453**	**$1,165,186**		

FIM Table: Hauge Administration

Building	FIM Code	Measure Description	kWh Savings (Scope 2)	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Hauge Admin	3.01-ADM	Upgrade the cabinet heaters for better air distribution and thermal comfort. Upgrade the AC and heat pump units to high efficiency models and implement air side economizer where possible, (3 cabinet heaters in the corridor, (3) 5-ton packaged heat pumps with air-side economizer on 1st floor ground, (6) 3-ton split AC units)	24,600	$738	$140,748	190.7	0.8
Hauge Admin	13.01-ADM	Replace the windows with high performance glazing to reduce heating and cooling loads. (4x88 5'x6' windows, 8x88 2'x2' windows and 8x88 2'x2' operable windows)	172,890	$5,187	$1,483,727	286.1	5.7
TOTAL			**197,490**	**$5,925**	**$1,624,475**		

FIM Table: Rieke Science Center

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	CCF Savings Sewer/ Water	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Rieke	9.02-SCI	Install occupancy sensors to control the lighting and install photo sensors for day lighting control. (6 photo sensors and 50 occ sensors)	0	48,579	0	$2,179	$26,658	12.2	1.6
Rieke	9.01-SCI	Upgrade the T12 to T8 and MH to T5 HO.	0	13,395	0	$402	$10,655	26.5	0.4
Rieke	3.02-SCI	Install control valves to the fume hoods, upgrade the fume hood exhaust fans and operate the fume hoods in VAV mode. Pay attention to the control of the supply, general exhaust and fume hood exhaust fans to maintain the pressure dependence. Total of 28 fume hoods. Install control valves for the hoods. Re-route the fume hood exhaust duct and combine the exhaust to two FEF's in north and south fan room and install VFD (10hp and 20hp).	3,703	58,452	0	$6,389	$162,440	25.4	21.5
Rieke	1.02-SCI	Replace the Lab HW heater with a condensing model with similar capacity.	5,000	0	0	$5,150	$43,634	8.5	26.5
Rieke	1.03-SCI	Install insulation on the HW piping and pumps. (20 ft 2" HW piping and 3 pumps)	800	0	0	$824	$4,275	5.2	4.2
Rieke	3.01-SCI	Replace existing AHU fan motors with premium efficiency motors and add VFDs and modulate the fan speeds based on space temperature or return temperature. Note: Careful attention to building pressurization will be required in the development of this FIM. Total of (5) AHUs: (2) 50hp, (1) 40hp, (1) 20hp, (1) 15hp, (1) 7.5hp, (2) 5hp. (1) 10hp EF.	3,581	187,299	0	$10,402	$232,171	22.3	25.2
Rieke	2.01-SCI	Replace the motor with a premium efficiency induction motor, (1) 7.5hp motor.	0	16,630	0	$499	$21,850	43.8	0.6
Rieke	4.01-SCI	DDS controls upgrade. (5) AHU's with SF/ RF, heating and cooling coils and (2) of them have HRC, (28) Fume hood EF's, (6) general EF's, (14) pumps, (9) HW cabinet or unit heaters, (1) 180-ton air cooled chiller, (1) chilled water pump, (2) gas-fired HW boilers, (2) hw heaters, (1) fluid cooler, (3) AC units and (202) VAV/ CV HW reheat terminal units.	12,282	146,799	0	$17,054	$186,193	10.9	69.9
Rieke	18.01-SCI	Upgrade the toilets to 1.28 gpf model, urinals to 1/ 8 gpf and install 0.5 gpm aerators on faucets.	254	0	330	$2,964	$26,419	8.9	1.3
TOTAL			**25,620**	**471,154**	**330**	**$45,862**	**$714,294**		

FIM Table: Xavier Hall

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	CCF Savings (Sewer/ Water)	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Xavier	1.01-XAV	Install (1) 1000 MBH hot water condensing boiler in the first floor mechanical room. The scope includes installing ducted vent for combustion air and installing stainless steel flue.	5,937	0	0	$6,115	$173,714	28.4	31.4
Xavier	4.01-XAV	Provide a supply duct CO2 sensor for main AHU's - this sensor will detect "unused" return air and modulate the outside air damper accordingly. Total of (3) supply air CO2 sensor kits	1,524	34,800	0	$2,614	$14,625	5.6	9.2
Xavier	18.01-XAV	Upgrade the toilets to 1.28 gpf model and urinals to 1/8 gpf. (4 urinals, 7 toilets, 8 faucets)	143	0	186	$1,666	$14,297	8.6	0.8
Xavier	25.01-XAV	Perform retro-commissioning on the major mechanical systems. The scope includes performing P2P and Functional Performance Tests on major mechanical equipment.	813	20,000	0	$1,437	$20,475	14.2	5.0
TOTAL			**8,416**	**54,800**	**186**	**$11,832**	**$223,111**		

FIM Table: Mortvedt Library

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	CCF Savings (Sewer/ Water)	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Mortvedt	1.01-LIB	Install (2) 2000 MBH hot water condensing boiler in the first floor mechanical room. The scope includes installing ducted vent for combustion air and installing stainless steel flue.	12,373	0	0	$12,744	$299,779	23.5	65.5
Mortvedt	4.02-LIB	Full DDC upgrade to all terminal boxes and zone t-stats. Implement energy saving features to terminal boxes such as DAT reset and night setback.	1,199	83,990	0	$3,755	$39,000	10.4	9.1
Mortvedt	2.01-LIB	Upgrade and optimize CHW system: Remove existing 150 ton CH-1 and replace with new three new 50 ton/ each modular water cooled modular chillers. Replace existing CHW pump and CDW pumps like-for-like with new pumps. Connect new modular CH-1 to the existing CHW and CDW piping. Provide new DDC controls to operate new CH-3.	0	111,281	0	$3,338	$627,935	188.1	3.7
Mortvedt	4.01-LIB	HVAC: Install VFD for SF-1, SF-2 and RF. (Motor upgrade is not included in the scope). Upgrade the existing built-up air handling unit (main supply fans, return fan and associated damper and valve actuators and temperature/ pressure sensors) to a direct digital control (DDC) system. Implement enhanced time of day (TOD) scheduling, optimal start, morning warm-up, and static pressure reset. Note that this measure excludes upgrading any of the terminal boxes, as it is expected that this would be cost prohibitive. Lighting: Install three new lighting control panels (one per floor) that will turn all of the lights on and off based on a programmable time of day schedule. New lighting panels to be interfaced with new HVAC control system.	3,526	735,950	0	$25,710	$132,042	5.1	43.1
Mortvedt	2.04-LIB	Perform refurbishment of existing cooling tower. Refurbishment scope includes the following: cleaning and resurfacing the lower tower interior basin and sidewall, including new fire resistant Evapliner coating. Reconditioning the existing fan snouts, replacing existing fill with new fill and fill supports, refurbishment of existing steel supports and tower piping above the roof line, and replacement of existing mechanical shaft bearings. Install new 20 HP VFD on existing CT-1 fan and provide new controls to modulate fan speed to maintain CDW set point. Additionally, as an alternate two new 6" each manual isolation valves can be installed on the existing tower for future maintenance needs.	0	55,000	0	$1,650	$105,666	64.0	1.8
Mortvedt	9.02-LIB	Install occupancy sensors to control the lighting (100 occ sensors)	0	122,772	0	$3,683	$114,480	31.1	4.1
Mortvedt	2.02-LIB	Install non-chemical condenser water treatment system. (6" CW piping and 600 gpm flow)	0	0	90	$3,319	$32,658	9.8	0.0
Mortvedt	2.03-LIB	Insulate the chilled water piping. (80 ft 4" piping and 6 chw/ cw pump)	0	1,100	0	$33	$3,846	116.6	0.0
TOTAL			**17,098**	**1,110,093**	**90**	**$54,233**	**$1,355,406**		

FIM Table: Harstad Hall

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Harstad	9.01-HAR	Upgrade the T12 lighting to T8. (43 fixtures and lamps)	0	7,534	$226	$5,573	24.7	0.2
Harstad	1.01-HAR	Install (2) 2000 MBH hot water condensing boiler in the first floor mechanical room. Install flat plate heat exchanger for DHW. The scope includes installing ducted vent for combustion air and installing stainless steel flue. Convert the existing steam heating system to hot water system. (total about 220 radiators)	21,098	0	$21,731	$1,857,175	85.5	111.7
Harstad	1.02-HAR	Install insulation on steam piping and condensate piping. (about 100 ft 2" steam piping and 100' 4" condensate piping, (1) 200 gal DHW storage tank)	10,483	0	$10,797	$9,200	0.9	55.5
TOTAL			**31,581**	**7,534**	**$32,755**	**$1,871,947**		

FIM Table: Ramstad Hall

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	CCF Savings (Sewer/ Water)	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Ramstad	1.01-RAM	Install (1) 2000 MBH hot water condensing boiler in the first floor mechanical room. The scope includes installing ducted vent for combustion air and installing stainless steel flue.	4,436	0	0	$4,569	$140,352	30.7	23.5
Ramstad	3.01-RAM	Replace these VAV boxes. (28 dual duct VAV boxes)	0	0	0	$0	$144,213		0.0
Ramstad	9.01-RAM	Install occupancy sensors to control the lighting. (about 20 occ sensors)	0	25,430	0	$763	$11,520	15.1	0.8
Ramstad	18.01-RAM	Upgrade the toilets to 1.28 gpf model, urinals to 1/8 gpf and install 0.5 gpm aerators on faucets. (11 toilets, 11 faucets, 2 urinals)	149	0	194	$1,745	$16,919	9.7	0.8
TOTAL			**4,585**	**25,430**	**194**	**$7,077**	**$313,003**		

FIM Table: Names Fitness Center

Building	FIM Code	Measure Description	kWh Savings (Scope 2)	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Names	9.01-FIT	Upgrade the MH lighting to T5HO and install occupancy sensor for these fixtures. Install day lighting control for second floor perimeter T8 lighting. Install (2) photo sensors.	13,239	397	$12,009	30.2	0.4
Names	4.01-FIT	Provide a return air CO2 sensor for the AHU to control the outside air damper.	42,121	1,264	$9,600	7.6	1.4
TOTAL			**55,360**	**1,661**	**$21,609**		

FIM Table: Ingram Hall

Building	FIM Code	Measure Description	Therms Savings (Scope 1)	kWh Savings (Scope 2)	CCF Savings (Sewer/ Water)	Total Cost Savings	Project Cost (Before Rebates)	Simple Payback (Years)	Annual MTCDE Reduced
Ingram	4.02-ING	Provide a return air CO2 sensor for the AHU to control the outside air damper.	239	0	0	$246	$9,600	39.0	1.3
Ingram	3.01-ING	Replace (6) existing split system heat pump units with high efficiency model. (2400 cfm, 5.5 ton; 2000 cfm, 5 ton; 700 cfm, 1.5 ton; 600 cfm, 1.5 ton; 750 cfm 1.5 ton; and 1800 cfm, 4 ton)	0	45,600	0	$1,368	$91,612	67.0	1.5
Ingram	18.01-ING	Upgrade the toilets to 1.28gpf model, urinals to 1/8gpf and install 0.5 gpm aerators on faucets.(8 toilets, 2 urinals, 8 faucets)	142	0	185	$1,658	$12,971	7.8	0.8
Ingram	4.01-ING	Install DDC system for the main mechanical system. (6 heat pumps, 1 makeup air unit, 5 AHU's, 6 EF's)	1,077	41,292	0	$2,348	$83,754	35.7	7.1
TOTAL			**1,458**	**86,892**	**185**	**$5,620**	**$197,938**		

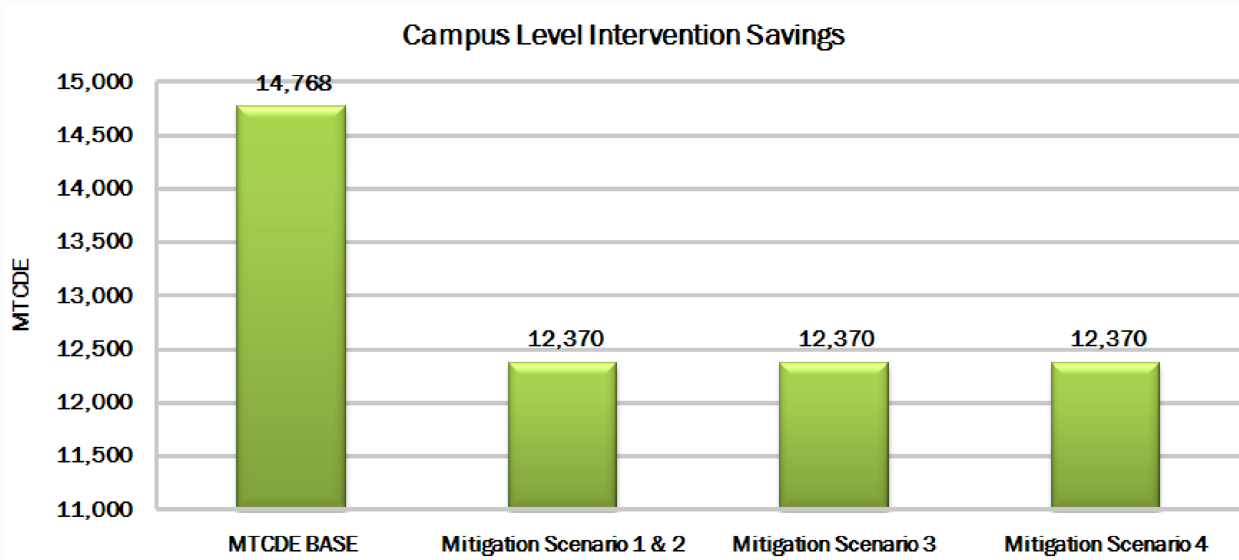
Mitigation Scenario 3

In addition to conservation projects, PLU could further mitigate its CO2 emissions by implementing renewable energy projects. However, at this time it is not recommended that renewable technologies be implemented solely to mitigate carbon emissions. This is primarily due to the fact that currently the purchase of CO2 off-sets is a significantly more cost effective option. As time goes by, it is very likely that it will become more cost effective to implement renewable energy technologies, due to the established Cap and Trade Market increasing the demand for carbon offsets. As such, Mitigation Scenario 3 is shown as having no effect on the carbon footprint over the next five years.

PLU is looking into solar voltaic and solar thermal as a means of addressing its carbon footprint. PLU is interested in pursing renewable technology for carbon footprint reduction as well as other value-added benefits of reducing its dependence on purchased grid electricity.

Mitigation Scenario 4

Renewable energy savings estimated are accounted for in Mitigation Scenario 3 and the remaining off-set requirement is accounted for in Mitigation Scenario 4. For the purpose of this report we have used a cost of $7/MTCDE as the off-set cost based upon current market prices.



5. Implementation Strategy

To reach carbon neutrality, PLU will need to implement strategies across campus to reduce emissions. This report identifies opportunities for facility improvements that will reduce carbon emissions and increase energy efficiency.

The analysis for this report is based on surveys of 12 buildings on the PLU campus, each representing a different representative building category. Data from these seven buildings was then extrapolated across the

PLU facilities within the similar category to estimate potential carbon savings and costs. Based on this approach, it is estimated that PLU can see a reduction of almost 2,000 MTCDE.

Below is a suggested implementation strategy for the first two years of the 10 year implementation timeline. These projects address carbon savings as well as some of PLU's immediate infrastructure needs. While these projects are being implemented, PLU will need to survey the remaining facilities on campus. Once all of the buildings have been surveyed an implementation strategy can then created for the next eight years.

It is suggested that PLU take a holistic approach when creating an implementation strategy across the entire campus. This can be done by creating a Facility Improvement Measure Impact and Decision Matrix. This matrix will allow PLU to evaluate measures based on a number of factors in addition to carbon reduction and energy savings. An example of this matrix is shown below.

FIM #	FIM Name	Building	Energy Savings (Energy Payback)	Carbon Reduction	Safety / Code Compliance	Immediate Infrastructure Needs	Comfort Improvement	Maintenance Savings	Weighted Composite Score
Weighting Factor			5	3	5	4	2	2	
1.00			4	5	3	3	3	2	82
2.00			3	3	1	1	3	1	43
3.00			1	2	5	5	5	5	74

Additional categories shown above that PLU may want to consider when evaluating measures are: safety / code compliance, immediate infrastructure needs, comfort improvement, and maintenance savings. The importance of each of these categories can then be weighted allowing the measures to be ranked based on a weighted composite score.

PART 7: RENEWABLES

PLU will continue to investigate all possible renewable technologies that can be used to mitigate its carbon emissions. Below is an explanation of the issues regarding each approach as it relates to Pacific Lutheran University.

1. Solar Photovoltaics

Solar photovoltaic technology (PV) is one of the most common and recognizable forms of renewable energy available today. The main benefit to using PV as an electricity source is its adaptability to any size or type of building. The current cost of PV panels and their installation is the largest obstacle for installing PV on the PLU campus. However, the cost of PV panels has been declining, and is expected to further drop over time as the technology improves and demand increases. Additionally, more incentives are becoming available to help fund PV projects which are making the installations increasingly affordable. Expand on becoming more cost effective, look to seek funding for pilot projects that may yet not be cost effective. PV is not the most viable option to offset carbon as electricity makes up such a small percentage of PLU's carbon footprint (approximately 1%). This is due to the fact that the electricity PLU purchase from Parkland Light and Water comes almost exclusively from hydro sources, with much of the remaining coming from nuclear and wind sources. However, there is a novelty to being "off grid" and PLU could capitalize on that to market a sustainable campus culture through software such as Fat Spaniel.

2. Wind Turbines

Wind Turbines are another option that would allow PLU to generate electricity on-site. They come in a variety of different sizes and are somewhat scalable which allows them to be sized based on building size and load. There are a few issues that do not make this technology a viable option to offset carbon on the PLU campus. Like PV, the first is the current cost of the wind turbines and their installation. The cost of wind turbines is declining, which combined with incentives will make these installations more viable over time. The second is the lack of strong winds at the PLU campus. The power production from a wind turbine is a function of wind speed. The relationship between wind speed and power is defined by a power curve, which is unique to each turbine model and, in some cases, unique to site-specific settings. Variability in the wind resource results in the turbine operating at continually changing power levels. At good wind energy sites, this variability results in the turbine operating at approximately 35% of its total possible capacity when averaged over a year. At poor wind energy sites, this variability can result in the turbine operating at less than 5% of its total possible capacity when averaged over a year. While a wind study has not been performed at the PLU campus, we would estimate wind turbines would operate towards the lower end of the range with the available wind resource on campus. Finally, like PV, wind turbines produce electricity, which is such a small percentage of PLU's carbon footprint. As with PV, if PLU is ever required to use a regional or national emissions value to calculate its Scope 2 emissions, wind turbines would become a more viable option to reduce the University's carbon footprint.

3. Biomass Boilers

Biomass boilers may seem like a good fit for PLU at first glance based on the fact that the majority of the Scope 1 and 2 emissions generated by the campus are a result of heating the buildings with natural gas or steam. The drawback with biomass boilers is that they require significant infrastructure investment and can be logistically complicated. Some things to consider when planning a biomass installation are availability of a fuel source, fuel storage, and delivery. Additionally, thoughtful design of the biomass fuel storage, delivery process, fuel extraction, and access for maintenance are important to an efficient operation a biomass installation. Biomass is a low energy density fuel, and consequently a large volume must be stored on site, and a sufficient reserve safety margin maintained. There must therefore be a suitable area, sufficiently close to the intended site of the combustion equipment to avoid an unacceptably long fuel feed and also accessible to the intended delivery vehicles. Biomass installations often require frequent deliveries, the logistics of which can be difficult in an urban environment. A secure dry fuel source is currently unavailable, although PLU would be interested in reconsidering biomass boilers if one was found.

4. Solar Hot Water

Solar Hot Water is an effective renewable energy source in the temperate Pacific Northwest climate. For the purposes of this analysis, solar hot water was treated as a Facility Improvement Measure rather than a renewable energy technology, and was considered where applicable. It was lumped with the FIMs due to the fact that costs and energy savings are dependent on the building type, hot water load, and use schedule. Savings from solar hot water can been found in the FIM tables in Appendix Section 3. As PLU moves forward with Facility Improvement Measures over the next five years it is expected that more opportunities for solar hot water will be identified.

PART 8: FUNDING SUSTAINABILITY PROJECTS

This plan provides strategies, projects and initiatives that PLU can use to achieve its goal of carbon neutrality and increase sustainability on campus. It is crucial that ongoing support for these initiatives be established to ensure the ongoing development of these projects and future ideas. There are many potential sources for funding these projects.

a. Committed, Rollover Budget – In order for PLU to effectively maintain a robust sustainability program in place, it is critical that this be made a budgetary priority that will receive committed funds on a yearly basis. Another important consideration is to create a sustainability budget that has rollover capabilities. Many of the programs initiated under this umbrella will provide significant paybacks that should be used to fund additional projects, rather than strictly returning to the general budget. By rolling over savings from implemented projects, sustainability projects will be self-funding, requiring lower capital investment.

b. Capital Project Savings – With capital improvements to campus facilities, PLU will see significant savings on utility bills. These savings should, at least in part, be used to fund further improvements on other buildings rather than go straight back into the general university fund.

c. Green Fee Grants – PLU implemented a Green Fee that funds sustainability projects on campus. This program has enabled student projects to become a reality, and has shown great success with projects like Take Back the Tap and Bring Back the Bike. PLU should consider increasing this $20 Green Fee so that more Office of Sustainability projects can be funded.

d. Federal, State and Local Grants –As an institution with standing as a nonprofit, this could open doors to project funding opportunities. PLU should continue to explore grants available for larger capital sustainability and efficiency projects. Adding a staff position as a designated grant writer would help PLU more effectively pursue these funding opportunities.

e. Philanthropic funding – The Development Office will be consulted as to how best to approach alumni or other specific individuals with an interest in sustainability initiatives.

f. Annual Capital Projects Process – Projects identified in this report will be denoted as special importance when brought to the Capital Projects committee.

CONCLUSION

PLU has been successful in being able to merge the academic, student and staff cultures, making it a leader is all aspects of sustainability. PLU has taken the proactive role in being the first private university in the region to build LEED Gold building. It leads its athletic conference in purchase of renewable power. PLU was just recently identified as one of twenty-six universities and colleges to obtain the highest rating on sustainability by the Sustainable Endowments Institute.

By focusing on steps that PLU can and will need to take in order to achieve the requirements of the ACUPCC and increase sustainability, the campus can pull together to make this goal a reality. By ensuring that climate protection and sustainability are actively incorporated into every aspect of the institution, PLU will remain loyal to its mission: seeking to "educate students for lives of thoughtful inquiry, service, leadership and care - for other persons, for the community and for the earth." Success of the goals outlined in this plan will require ongoing commitment from faculty, staff, administrators, students and the local community, as well as consistent updates and revisions to the report as goals evolve. These efforts will help in making PLU truly sustainable, and all will benefit from the results.