FRANKLIN
UNIVERSITY SWITZERLAND

CLIMATE ACTION PLAN

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The Road to Carbon Neutrality: Franklin University Switzerland's Climate Action Plan

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Key terms: *Academic Travel, Climate Action Plan, climate neutrality, carbon offsets, green offices, mitigation strategies, solar energy, whole-of-university approach*

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FRANKLIN UNIVERSITY SWITZERLAND

Executive Summary

Introduction

Climate scientists agree that human activity is causing the recorded rise in global average temperatures from pre-industrial levels (IPCC, 2018). Since 2015, 185 parties have ratified the Paris Agreement, the purpose of which is to limit the rise in global average temperatures to a maximum of 2°C, and ideally under 1.5°C, by the end of the century as compared to pre-industrial levels (UNFCCC, 2015a). The United States and Switzerland are adherents to the Paris Agreement, and have set their own Nationally Determined Contributions (NDCs) in pursuit of the agreement's goals. As an institution with dual accreditation in Switzerland and the United States, it is key for FUS to address both U.S. and Swiss climate action commitments within its own plan. Our Climate Action Plan serves as a guideline for how FUS can be a responsible actor in local, national, and global sustainability efforts.

Emissions

It is important to note that CO_2 is only one of several significant greenhouse gases (GHG) that must be addressed in the mitigation of climate change. We considered the emissions from a variety of sources, including CH_4 and NO_2, according to their capacity to contribute to the greenhouse effect in comparison to CO_2, referred to as eCO_2. The use of carbon dioxide equivalence (eCO_2) allowed us to perform a complete, quantifiable analysis of FUS's total emissions based on the data we gathered. In order to successfully create mitigation strategies for Franklin University Switzerland (FUS), we gathered data regarding the institution's eCO_2 emissions and impact. We then analyzed the data using the Sustainability Indicator Management and Analysis Platform (SIMAP).

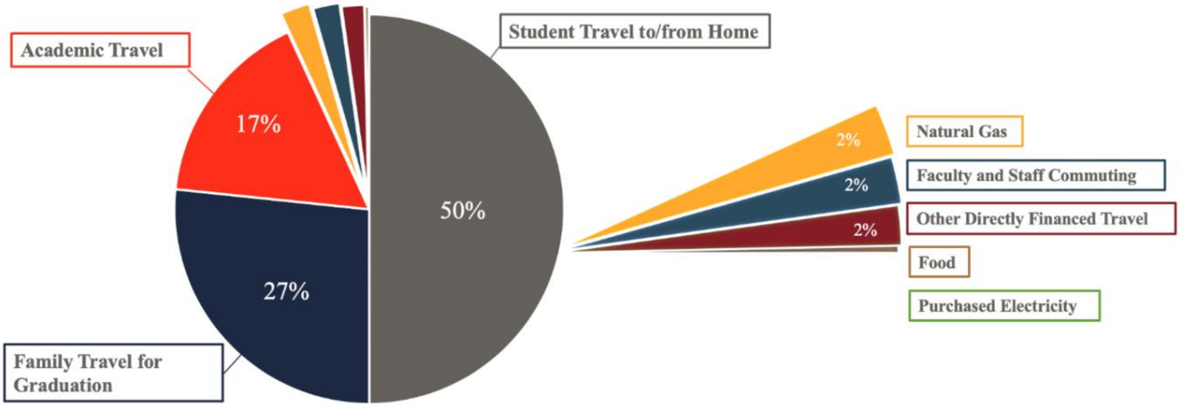


Figure ES1 (Figure 2.1): FUS total baseline emissions by source.

The largest source of emissions from FUS is related to independent travel, as shown in Figure ES1. Many universities choose to omit data related to student travel to/from home, as well as families traveling for graduation from their climate action plans, as they are not directly financed by the university. However, because FUS is made up of an international student body, we consider these travel data to be essential in creating a holistic evaluation of FUS's eCO_2 emissions. Despite this, it is important to note that in creating this Climate Action Plan, we created mitigation strategies only for FUS's directly financed activities, shown in Figure ES2, as the university only has direct control over these categories of activities. The categories we addressed are direct fuel emissions from on-campus sources, purchased electricity, food purchase and consumption, and all travel sources financed by the university.

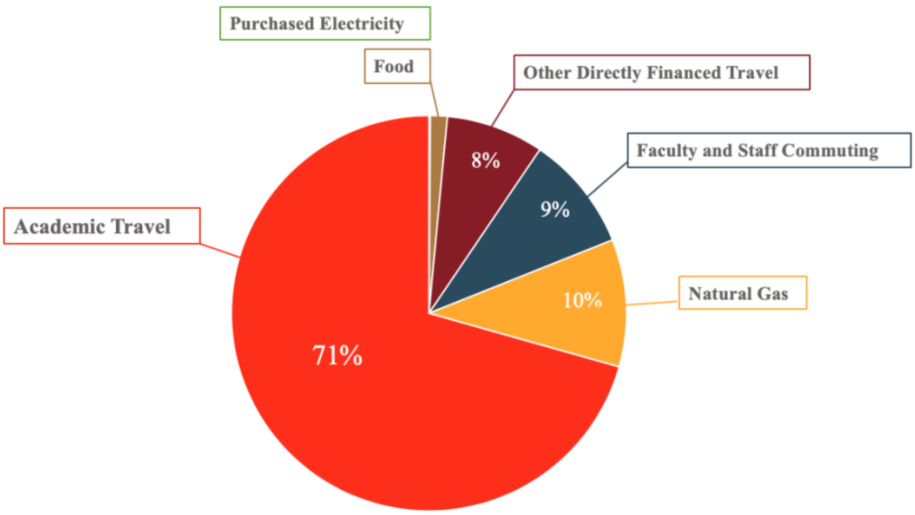


Figure ES2 (Figure 2.2): FUS directly financed baseline emissions by source.

Mitigation

After gathering and evaluating the relevant data, we identified specific mitigation strategies and accompanying targets to implement into our Climate Action Plan. We then developed three goals to mitigate greenhouse gas emissions at FUS (Table ES1).

Goal	**Associated Climate Action Goal**
Minimum	26-28% reduction in eCO_2 emissions by 2025, in line with the US Nationally Determined Contribution (NDC) to the Paris Agreement (USDOS, 2016)
Moderate	50% reduction in eCO_2 emissions by 2030, in line with the Swiss Nationally Determined Contribution (NDC) to the Paris Agreement (UNFCCC, 2015b)
Ideal	100% reduction in eCO_2 emissions (carbon neutrality) by 2050

Table ES1 (Table 1.2): Overview of our suggested goals for reducing FUS's emissions

Mitigation Strategies

In this climate action plan, after completing the evaluation of relevant data, we outline specific strategies which are necessary for FUS to reduce eCO_2 emissions. We then develop three main mitigation strategies for FUS to implement, in addition to projections for meeting our targets, which build upon each other to achieve our Ideal Goal of climate neutrality. We targeted these three mitigation strategies to address FUS's directly financed activities.

Food Purchase and Consumption

The first strategy we developed to meet our long-term sustainability goal relates to food consumption on campus. We recommend that various measures be instituted to mitigate the overall impacts of FUS's food consumption in terms of energy, industry, agriculture, and land-use (UN, 2016; UNFCCC, 2015b). We specifically recommend the expansion of compost facilities on campus, the reduction of food waste, and encouragement of sustainable food consumption with events such as Meatless Mondays, and other personal tips for how to eat. In addition, we propose the following strategies for achieving FUS's Minimum, Moderate, and Ideal Goals, shown in Table ES2.

Goal	Food	Associated Climate Action Goals
Minimum	Beef-free campus	26-28% reduction in eCO_2 emissions by 2025
Moderate	Meat-free campus	50% reduction in eCO_2 emissions by 2030
Ideal	100% carbon neutral food consumption	100% reduction in eCO_2 emissions by 2050

Table ES2 (Table 3.1): Our suggested goals for reducing FUS's emissions through food mitigation strategies

Energy Usage (Solar Panels)

The second strategy is to increase the number of solar panels installed on campus. In December of 2018, FUS established a solar energy project by installing 152 solar panels on two of the residence halls (New Buildings A and B). The project has successfully mitigated more than 12 metric tons of CO_2 (as of early May 2019). This shows that the implementation of further solar panels on campus would be beneficial in securing FUS's carbon neutral future. We identified eight possible locations for further solar panel installation and ranked them in order of their suitability and viability in reaching FUS's Minimum, Moderate, and Ideal Goals, shown in Table ES3.

Goal	Solar Energy	Associated Climate Action Goal
Minimum	Current New Building solar panels	26-28% reduction in eCO_2 emissions by 2025
Moderate	Installing solar panels on locations 1 – 4	50% reduction in eCO_2 emissions by 2030
Ideal	Installing solar panels on locations 1 – 8	100% reduction in eCO_2 emissions by 2050

Table ES3 (Table 4.1): Our suggested goals for reducing FUS's emissions through solar panel mitigation strategies

Directly Financed Travel

Our third strategy addresses the significant portion of FUS's carbon footprint derived from kilometers traveled by students, staff, and faculty. The travel data that we gathered and report here include student commutes to and from FUS, weekly staff and faculty commutes, family travel to and from FUS for the graduation ceremony, Academic Travel, and all directly financed conferences attended by students, staff, and faculty. We acknowledge the importance of travel in FUS's curriculum and culture, and therefore have devoted significant attention to protecting this culture while promoting more sustainable practices. For this reason, we propose the following strategies for achieving FUS's Minimum, Moderate, and Ideal Goals, shown in Table ES4.

Goal	Travel	Associated Climate Action Goals
Minimum	Use of direct flights for academic travel courses	26-28% reduction in eCO_2 emissions by 2025
Moderate	Allocation of offsets from installation of new solar panels on locations 1-8	50% reduction in eCO_2 emissions by 2030
Ideal	Additional purchased offsets	100% reduction in eCO_2 emissions by 2050

Table ES4 (Table 5.1): Our suggested goals for reducing FUS's carbon emissions through travel mitigation strategies

Education, Research, and Community Outreach

We regard a "whole of university approach" (McMillin and Dyball, 2009) as an essential strategy for FUS to follow in its sustainability efforts. This means that curriculum, research, and campus operations must work synergistically when addressing issues related to climate change. We suggest that FUS adopt the following actions to the heighten understanding of sustainable practices on campus and beyond: create a core requirement regarding sustainability, require sustainable travel training for academic travel leaders, facilitate more sustainability-oriented research in various disciplines, increase outreach to people on campus regarding their own behavior, and expand the endeavors of the Center for Sustainability Initiatives (CSI). Altogether, greater integration of sustainability-related topics across FUS's disciplines is an essential step toward achieving our climate action goals.

1. Introduction

A growing body of evidence indicates that human activity is altering the planet's climate. The burning of fossil fuels releases greenhouse gases (GHG) into the atmosphere, which causes average global temperatures to rise. Carbon dioxide is one of the most recognized GHGs; however, other gases such as nitrous oxides, methane, and fluorinated gases also have profound climatic impacts (EPA, 2019). In its 2018 special report, the Intergovernmental Panel on Climate Change (IPCC) indicates that human activity is already responsible for about a 1.0°C increase in global average temperatures. It also states with "high confidence" that the global temperatures will rise by 1.5°C above pre-industrial levels between 2030 and 2052 (IPCC, 2018). The rise of global temperatures will have devastating effects on both the natural and human worlds with implications for political and economic stability. Climate change is already impacting both human and natural systems (IPCC, 2018). These impacts can take many forms: rising sea levels; increasing occurrence of forest fires in several global regions, including the Amazon Rainforest; increasing frequency of intense precipitation episodes; and longer and more severe droughts that are leading to food and water scarcity (WRI, 2014). As temperatures rise, these consequences will worsen.

In the case of Switzerland, the National Centre for Climate Services (2018) indicates certain impacts of climate change that threaten the country. There are four main impacts that Switzerland will experience by the year 2060: drier summers will impact farmers and agricultural revenues; more frequent episodes of intense precipitation will increase the risk of property damage; hotter days in the summer will enhance risks associated with human health; and lastly, snow-scare winters will threaten natural ecosystems and the winter-tourism industry (NCCS, 2018). In an earlier report specifically examining Ticino, researchers found that the average temperature in the southern Alpine region is rising at approximately double that of global average temperatures (MeteoSvizzera, 2012). The same report indicates that the number of days where temperature does not drop below 0°C and the number of days where it exceeds 25°C are on the rise. These anomalies in temperature are cause for concern and highlight the need for action, a call which is later echoed and built upon by the more recent NCCS report (2018).

In an effort to combat the impacts of climate change, 185 parties have ratified the Paris Agreement (UNFCCC, 2019). This pivotal global partnership signifies a collective movement towards mitigating and adapting to the consequences of climate change. The Paris Agreement aims to keep the global average temperature well below a 2°C increase compared to pre-industrial levels, and ideally to limit the increase to 1.5°C (UNFCCC, 2015a). Climate-related impacts on human and natural systems are significantly lower at 1.5°C than at 2°C, as indicated by Table 1.1 (IPCC, 2018; Schleussner et al., 2016).

Climate Impacts	**1.5°C increase**	**2°C increase**
Duration of heat waves on a global scale	1.1 months	1.5 months
Percent decrease in the availability of freshwater in the Mediterranean Sea*	9	17
Percent increase in the intensity of rainfall*	5	7
Percent decrease in the yields of specific crops in tropical regions*	Wheat: 9 Maize: 3	Wheat: 16 Maize: 6
Sea level rise in the year 2100 relative to 2000	40cm	50cm
Percentage of coral at risk of bleaching from the year 2050 onwards	90	98

Table 1.1: Effects of a 1.5°C increase versus a 2°C increase in global average temperatures over the 21st century.
*represents change in climatic impacts relative to 1986-2005.

As countries struggle to meet their emissions targets, the global community is not on track to keep rising temperatures below 1.5°C, or even below 2°C (CAT, 2018). According to the Climate Action Tracker report (2018), even if all parties follow their commitments to the Paris Climate Agreement, the globe will still see a 3°C rise in temperature by the year 2100. On an alarming note, recent models used by the IPCC to create its climate report indicate that warming may be higher than previously thought. Recent estimates project that the globe may face up to 5°C in warming, which would be devastating to natural and human systems (Voosen, 2019). Scientists are looking to understand why the most recent models project such high levels of warming. In order to reduce the impacts of climate change, immediate mobilization is required on behalf of all parties and all stakeholders, including the private sector.

Climate action plans provide a framework through which institutions, such as universities, can begin to understand their climate impact and craft a strategy to reduce it. A variety of U.S. universities have published climate action plans including Stanford University (2015) and Duke University (2009), which is currently in the process of updating its plan for 2019. In Ticino, nearby higher education institutions have not produced publicly accessible climate action plans. Currently, the only available document is a handout from the Università della Svizzera italiana (USI) about general sustainability recommendations for individuals on their campus (USI, 2011). Climate action plans generally provide an inventory of their respective institution's climate impacts (in the form of GHG emissions) and then proceed to make specific recommendations in key action areas. Second Nature is a nonprofit public benefit corporation with the goal of assisting institutions of higher education in creating cohesive climate action plans (Second Nature, 2019b). The corporation supplies institutions with the basic framework to structure a Climate Action Plan, but also encourages them to create plans that meet their campus's specific needs (Second Nature, 2019a). Our Climate Action Plan for FUS follows Second Nature's suggested guidelines.

The Paris Agreement also plays an important role in the framework of our Climate Action Plan. Each party beholden to the agreement has pledged a Nationally Determined Contribution (NDC) outlining how it will reduce its GHG emissions. The NDC for the United States indicates that by 2025, the country will reduce its GHG emissions by 26% to 28% relative to its 2005 emissions (USDOS, 2016). The Swiss NDC states that by 2050, Switzerland will reduce its GHG emissions by 50% relative to its 1990 emissions (UNFCCC, 2015b). FUS is a dually-accredited university in the United States and Switzerland, so we used the reduction targets of both countries as the basis for our Climate Action Plan (Table 1.2). We used the 2018 calendar year as a base year to compare future emissions levels.

Goal	**Associated Climate Action Goal**
Minimum	26-28% reduction in eCO_2 emissions by 2025 (US NDC)
Moderate	50% reduction in eCO_2 emissions by 2030 (Swiss NDC)
Ideal	100% reduction in eCO_2 emissions by 2050

Table 1.2: Overview of our suggested goals for reducing FUS's emissions.

Our three proposed climate action goals serve as a pathway for gradually achieving carbon neutrality. As a stakeholder in the global community and as a source of greenhouse gas emissions, it is essential that FUS take steps to reduce its climate impact. In our paper, we address how each reduction goal can be met by offsetting emissions from food and travel. Offsets counteract the impact of emissions through projects that mitigate atmospheric GHG levels either directly on campus – first-party offsets – or through investment in a third party. We then discuss how to implement sustainability into all levels of FUS and how to track progress in emissions reductions.

Travel mitigation is a significant portion of our paper, and while international aviation is not currently included in the NDC of any party, an international aviation agreement is forthcoming. This deal, called the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), aims to offset all increases in emissions from international air travel past the year 2020 (ICAO, 2019). As a whole, air travel accounts for 12% of the entire transportation sector's emissions (ATAG, 2019) and 2% of total human-related emissions (ATAG, 2019). International aviation accounts for approximately 1.3% of total human-related emissions (ICAO, 2019). Relatively, the aviation industry is responsible for a large proportion of emissions and so it must be considered in university climate action plans if we are to truly tackle the challenge of climate change mitigation. As an institution that directly finances and encourages air travel for students, staff, and faculty, we recommend that FUS seriously consider the climate impact of this form of travel and rethink how it travels.

Lastly, universities themselves are an ideal place to implement mitigation and adaptation strategies given their position as hubs for education, research, and community outreach (Mcmillin and Dyball, 2009). As centers of learning, universities have a multiplier effect (Ralph and Stubbs 2014) on students, meaning they can spread further change in the future. Currently, FUS's approach to sustainability is vague and the institution has not published a Climate Action Plan. While FUS has some sustainability initiatives, such as its inter-disciplinary sustainability-focused courses, the Center for Sustainability Initiatives (CSI), and the solar energy project, there is a lack of cohesive planning. Creating a clear climate action plan is an essential step for truly tackling climate change (Ralph and Stubbs, 2014).

Climate Action Plan Outline

This report begins with an overview of the methodology we employed when taking inventory of FUS's eCO_2 emissions. We then discuss the results of our inventory, including a brief analysis of the data we collected. Following this, we establish our three mitigation strategies to achieve our climate action goals regarding food, energy, and directly financed travel. Each section contains an overview of the related data in our baseline emissions inventory, as well as outlining specific suggestions and strategies that FUS can implement to achieve carbon neutrality by the year 2050. Subsequently, we discuss the importance of education, research, and community outreach within the institution, and we provide recommendations that can improve FUS's overall commitment to climate action. Lastly, we outline suggestions for future data collection and analysis in our tracking progress section.

2. Baseline Emissions Inventory

Methodology

It is important to note that CO_2 is only one of several significant greenhouse gases (GHG) that must be addressed in the mitigation of climate change. We considered the emissions from a variety of sources, including CH_4 and NO_2, according to their capacity to contribute to the greenhouse effect in comparison to CO_2, referred to as eCO_2. The use of carbon dioxide equivalence (eCO_2) allowed us to perform a complete, quantifiable analysis of FUS's total emissions. In order to successfully create mitigation strategies for Franklin University Switzerland (FUS), we gathered and analyzed data regarding the institution's eCO_2 emissions and impact. We then analyzed the data using the Sustainability Indicator Management and Analysis Platform (SIMAP). The SIMAP is a tool created specifically for U.S. and Canadian universities as a means of measuring, calculating, and reporting carbon and nitrogen footprints (UNH, 2019). Its goal is assisting and facilitating the adoption of sustainable practices on college campuses through the quantification of emissions associated with university operations. SIMAP divides the sources of GHG from all university functions and operations into three separate scopes. The first covers all direct emissions by the organization, while the second covers indirect emissions through purchases, such as energy consumption. The third scope accounts for so called "upstream" and "downstream" activities, which includes commuting, travel, and transportation of purchased goods. Additionally, institutions may account for any sinks or offsets they might have. These scopes and their sources are summarized in Table 2.1.

Scope	Definition	Included Sources
Scope 1	Direct emissions from fuel sources used for on-campus functions	Data from energy bills for 2018 calendar year
Scope 2	Purchased electricity	Purchased utilities data acquired through utilities bills
Scope 3	Directly and non-directly financed transportation, food purchase and consumption	Data for Academic Travel, student, staff, and faculty commuting, visitation for annual graduation ceremony, admissions staff travel, dining hall food purchase and consumption, and travel for conferences. Data gathered from Academic Travel itineraries, Office of the Registrar, Office of Admissions, Dining Services, and Professor Brack Hale, respectively.[1]

Table 2.1: Summary of scopes and included sources

We made assumptions while creating this emissions inventory, as full and precise information is not always readily available, especially regarding commuting due to confidentiality of student, staff, and faculty home locations. Major assumptions regarding scope three include the size of Academic Travel classes and transportation methods during the course, the home locations of students, the average size of families visiting for graduation ceremonies, etc. For a full list of assumptions, refer to Appendix A.

[1] Not included in Scope 3: health services, solid waste production, ship travel related to food transport and extraneous academic travel activities

Baseline Emissions Inventory Results[2]

As shown in Figure 2.1, Scope 3 is the largest source of emissions at FUS and makes up over 95% of emissions data. We have listed all total carbon dioxide equivalent emissions, as well as percentages of the data made up by each source in Table B1 in Appendix B. Of note, these data are an underestimation, as we were not able to consider all data points (Box 2.1), although this provides a valuable baseline for recommendations and future measurement. Additionally, many universities choose to omit data related to student travel to/from home, as well as families traveling for graduation, as the data are not directly financed by the university. However, due to FUS's unique international student body, we chose to include these two categories to get a full picture of FUS's impact on the environment as a community for this initial analysis.

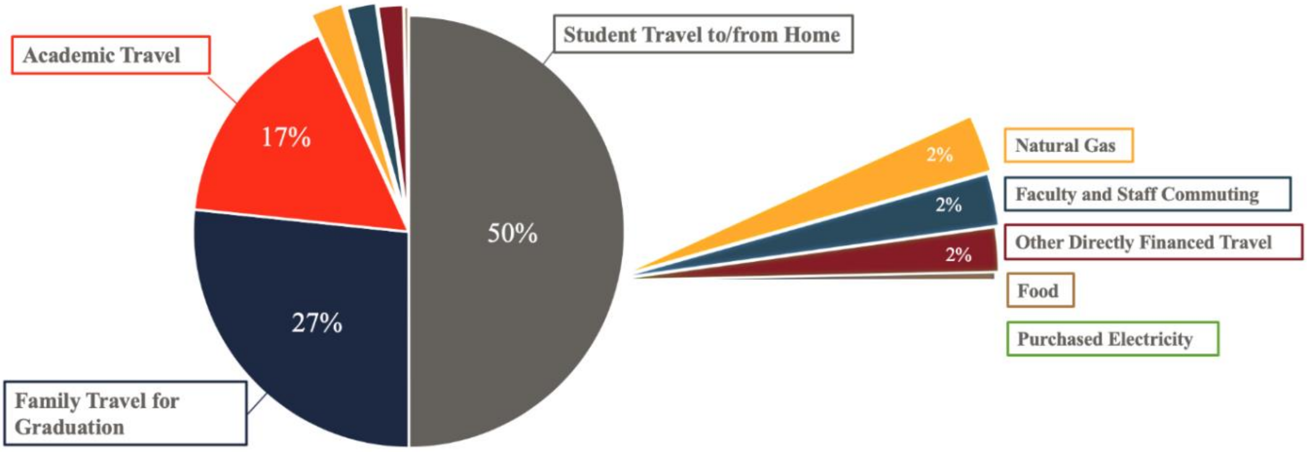


Figure 2.1: FUS total baseline emissions by source.

For our Climate Action Plan, we address six categories as shown in Figure 2.2, including direct fuel emissions from on-campus sources, purchased electricity (not visible on the figure), food purchase and consumption, and all travel sources financed by the university. All specific data can be seen in Table B1 and Table B2.

[2] All eCO_2 emissions and CO_2 offsets listed in metric tons unless otherwise labeled.

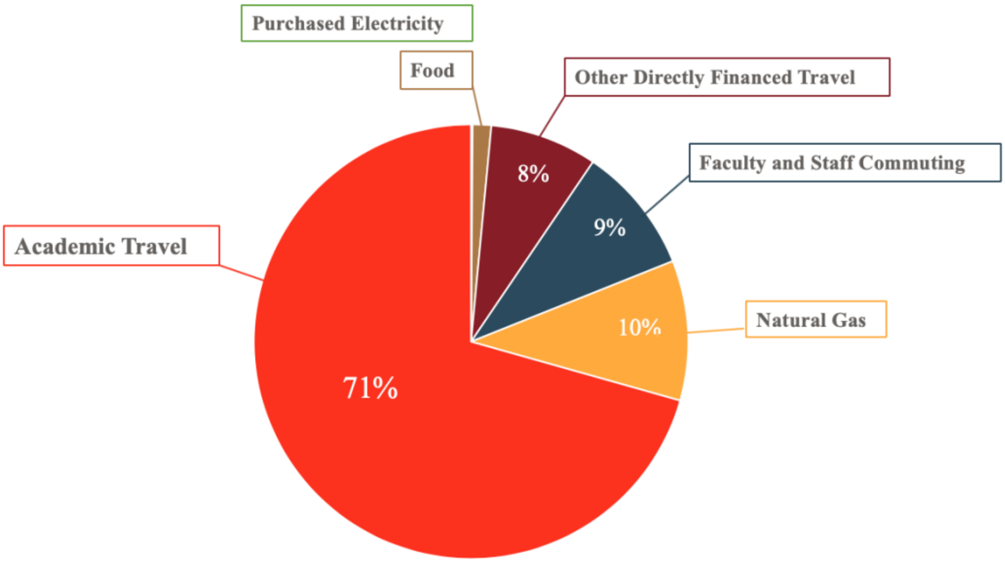


Figure 2.2: FUS directly financed baseline emissions by source.

Mitigation Strategies Overview

For the purposes of this Climate Action Plan, we identified the three mitigation strategies (contributing to both first-party offsets, and third-party offsets, see Box 2.1), most likely to effect change at FUS as the following:

Strategy 1: Food

Provide sustainably and locally sourced food for both campus dining halls, and reduce and recycle food waste.

Strategy 2: Energy

Reduce fossil fuel-related greenhouse gas emissions through the provision of renewable energy via solar panels.

Strategy 3: Travel

Make directly financed travels carbon neutral.

In order to achieve our climate action goals, these mitigation strategies are designed to work in conjunction with personal offsets, verifiable purchased offsets, and education efforts on campus.

Box 2.1: First-Party and Third-Party Offsets

First-party offsets- refer to investments in technologies or infrastructure designed to remove carbon dioxide from the atmosphere directly on campus. These can take the form of solar panels and carbon sinks.

Third-party offsets - refer to investments in an unaffiliated organization that invests in sustainability projects on behalf of the buyer. These can take the form of investments in renewable energies, carbon sequestration technology, or reforestation projects. We calculated all offset values in CO_2, as these use the final carbon dioxide values of the equivalent emissions.

3. Mitigation Strategy: Food Purchase and Consumption

Climate and Food

It is FUS's responsibility to provide sustainably and locally sourced food for both campus dining halls, and to reduce and recycle its food waste. Making an informed decision about the food we put on our plates and limiting fossil fuel-dependent meals is a form of everyday activism. In order to reach carbon neutrality by the year 2050, FUS will need to make significant changes in its food consumption patterns. While our food carbon footprint is minimal compared to that of travel, studies suggest that changing our diets is a more effective way to address climate change than focusing on habits related to energy use (De Witt, 2016). In other words, eating locally and seasonally will have a more significant impact on mitigating climate change than saving energy at home. This is not to say that we should not address both strategies, only that the FUS community would benefit from gaining insight into the link between food and climate change.

Goal Statement: 100% carbon neutral food consumption by 2050

Goals	Food	Associated Climate Goals
Minimum	Beef-free campus	26-28% reduction in eCO_2 emissions by 2025
Moderate	Meat-free campus	50% reduction in eCO_2 emissions by 2030
Ideal	100% carbon neutral food consumption + additional purchased offsets	100% reduction in eCO_2 emissions by 2050

Table 3.1: Our suggested goals for reducing FUS's emissions through food consumption mitigation strategies.

FUS and Food Consumption

FUS's food emissions inventory is comprised of the different types of perishable food products purchased for both campus dining halls (The Grotto and North Campus Dining Hall) in kilograms. The types of food are further categorized as local or non-local; "local" being defined as food originating from any combination of the following sources: Switzerland, Switzerland/Ticino, and Italy/Switzerland/Ticino. As seen in Figure 3.1, 80% of our purchased food is locally sourced.

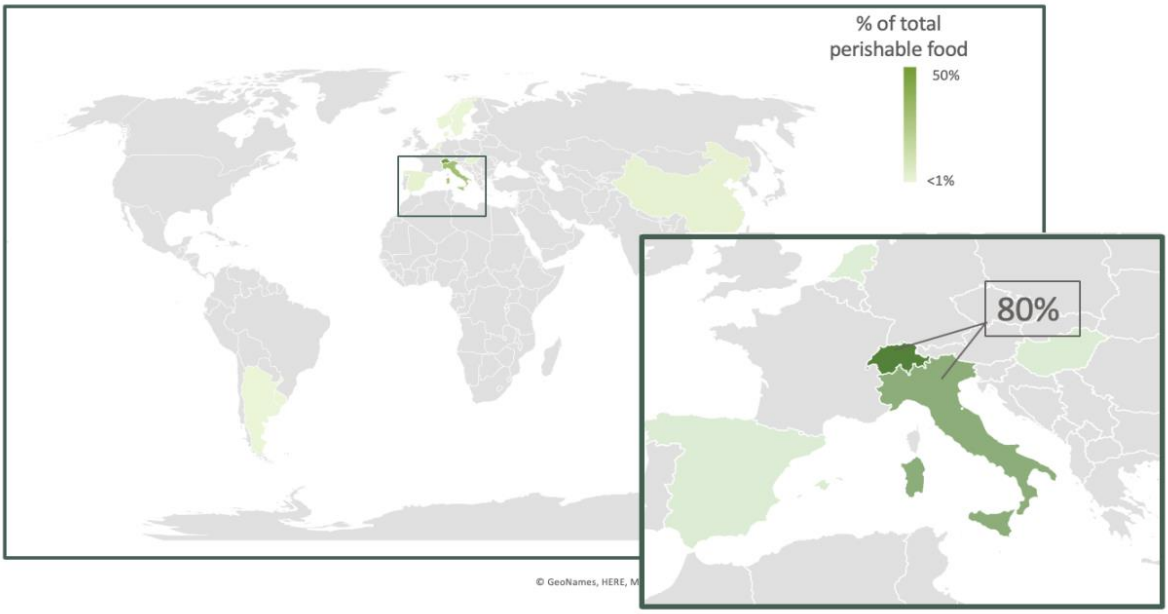


Figure 3.1: Map of sourced countries for perishable food consumed by FUS.

We analyzed the food data according to its type by weight and type by eCO_2. In Figure 3.2, the different types of food purchased by FUS Dining Services can be compared by their weight in relation to one another.

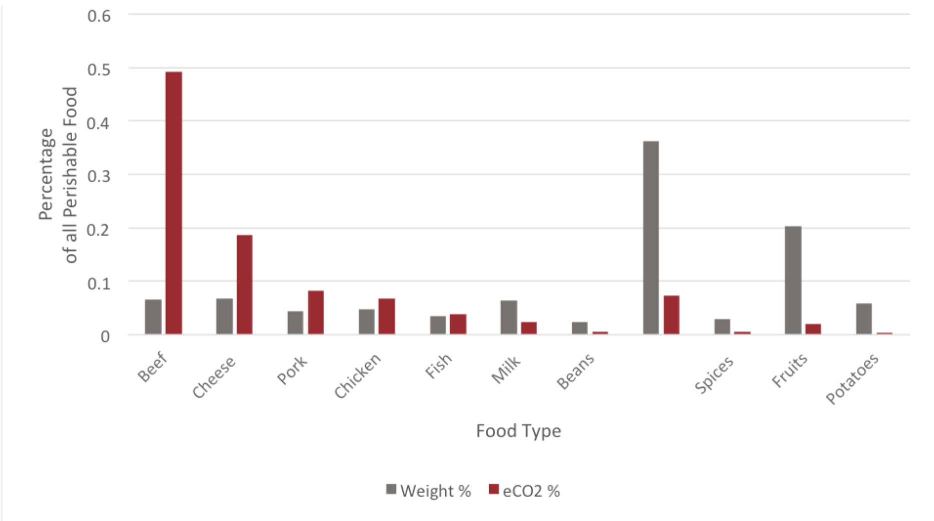


Figure 3.2: Type of Food Purchased by FUS Dining Services by Weight (kg) and eCO_2 emissions.

The total amount of food purchased for the 2018 fiscal year was 3,342 kg and the food categories purchased in highest quantities were local vegetables (including both fresh and frozen), local cheese, and local pork. To estimate the associated greenhouse gas emissions, we further analyzed the food data to determine the eCO_2 of each type of food purchased. The full details of our analysis are in Appendix D.

While local vegetables accounted for the highest quantity of food purchased by FUS, their impact on the climate is much lower than that of beef (both local and non-local), local cheese, and local pork. Beef and dairy products are responsible for the most emissions in global food production, accounting for 65% of the total GHGs emitted by livestock (Bailey et al., 2014). Emissions from meat production globally account for 2,837 metric ton eCO_2, and 1,419 metric ton eCO_2 for those of milk production (Gerber et al., 2013). To put FUS's food footprint in perspective, Table 3.2 illustrates the difference in GHG emissions from food production in varying types of food, including beef, pork, dairy, and vegetables. Based on the table, beef emits approximately 37 times more CO_2 equivalent per kilogram than vegetables, meaning that meat consumption at FUS must be reduced in order to meet our climate goals.

Type of Food	eCO_2/kg
Beef	26.11
Cheese	9.5
Pork	6.66
Chicken	5.04
Fish	3.83
Milk	1.30
Beans	0.76
Vegetables	0.71
Spices	0.70
Fruits	0.35
Potatoes	0.20

Table 3.2: FUS perishable food consumption emissions by food type

The greenhouse gas emissions associated with food do not account for their transportation to FUS, which is a limitation in this inventory. This is a minor limitation, however, considering that while the "food mile" tends to be the popular indicator of food-system sustainability, transporting food accounts for just 10% of food-system energy use (Bomford, 2010). Rather, the highest energy costs related to food production are food processing, packaging, storage, and preparation (Bomford, 2010). Another limitation in the calculation of the university's food inventory is the absence of multi-ingredient and non-perishable food groups. We estimate that more than half of the food consumed by both campus dining halls is accounted for in the current carbon footprint analysis. We encourage those who conduct future studies to use more comprehensive data in order to gauge the holistic effect of FUS's food consumption on the environment. Based on the information we have gathered, there are a host of actions that can be taken to lead FUS toward carbon neutrality by the year 2050.

Current Efforts

Although in its early stages, FUS is currently involved in efforts to mitigate its food-related emissions. Recently, the university's Center for Sustainability Initiatives (CSI) participated in Sustainability Week Switzerland, with the introduction of a Lugano-based program. The Lugano program ran from March 30- April 9, 2019 and featured events like a clothing swap, documentary screening, and Meatless Monday at the North Campus Dining Hall. Meatless Monday encourages individuals on campus to reconsider their dietary choices and to recognize the impact a meat-based diet has on the climate. The dining halls also discourage the use of take away cups and containers by charging CHF 1 for each single-use item. Furthermore, individuals at FUS have the option to use existing composting infrastructure as a carbon sink on campus.

Recommended Action

Efforts to moderate meat and dairy consumption are largely absent from mitigation strategies because doing so requires surpassing several social, economic, and political barriers (Laestadius et al., 2014). While there are social norms in place favoring the consumption of meat, evidence suggests that behavior can be changed through education efforts. A study conducted at a campus dining hall in the Midwestern United States with a sample size of 320 students found that changing the default cafeteria menu to vegetarian-only and moving meat-based options to a separate menu increased the proportion of vegetarian meals ordered by 50% (Campbell-Arvai et al., 2014). This intervention was considered statistically significant, and given the sample size of the study, can be applied to FUS's small student body, which had 333 full-time students in the 2018 academic year (FUS, 2019b). Given the high carbon footprint of a meat-based diet, our suggestions for meeting the Minimum, Moderate, and Ideal Goals hinge upon the conversion to a plant-based diet. Reducing meat consumption can be supplemented by other recommended individual actions (Box 3.1).

Box 3.1: Recommended individual actions for sustainable food consumption

- Reduce food waste and compost
- Bring your own cup and to-go containers to campus dining halls
- Limit trips to the grocery store
    - Carpool, walk, or use public transportation when possible
- Take the initiative to garden and help produce food locally
- Eat foods that are in season
- Learn more about meat's impact on the environment by attending events like Meatless Monday and documentary screenings

Goals

As stated in our climate goals (Table 3.1), removing beef from our diets will allow us to reach our Minimum Goal of a 26%-28% reduction in food-related eCO_2 emissions on campus by the year 2025. Creating a meat-free campus will take us to the Moderate Goal of a 50% reduction in food-related CO_2 emissions by the year 2030, and the addition of purchased offsets will secure carbon neutrality by 2050 (Figure 3.3). Since these goals require changes in consumptive behavior, small steps can be taken to reach them through regular implementation of sustainable events on campus. Currently, the event Meatless Monday is held at the North Campus Dining Hall twice a year. Our projections show that weekly implementation of this event during the academic year would bring FUS halfway to its Minimum Goal in eCO_2 emission reduction (Figure 3.4).

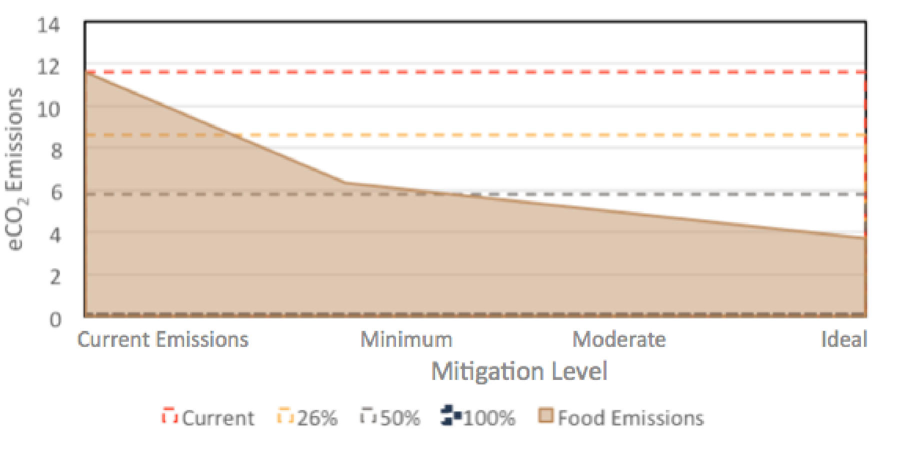


Figure 3.3: The contribution of food mitigation strategies in meeting our Minimum, Moderate, and Ideal Goals (eCO_2 emissions in metric tons)

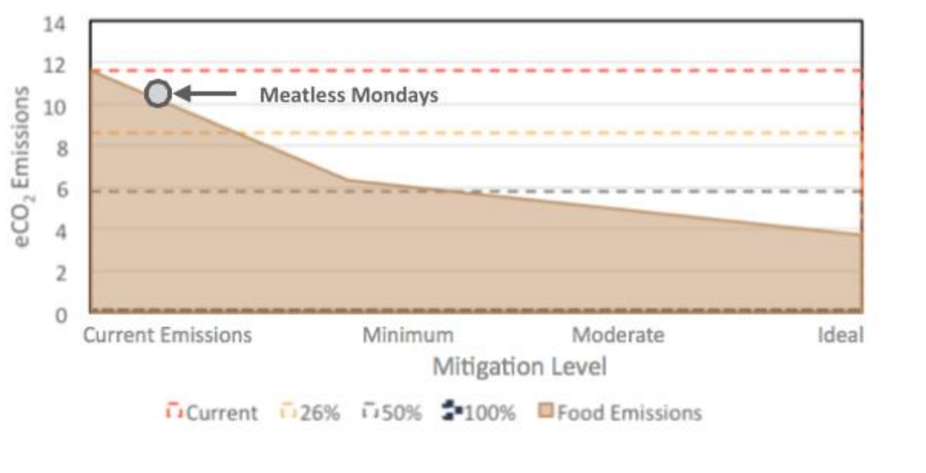


Figure 3.4: The contribution of Meatless Monday implementation in meeting our Minimum, Moderate, and Ideal Goals (eCO_2 emissions in metric tons)

Going one step further, reducing dining hall beef consumption by 50% will bring FUS within proximity to our Minimum Goal of a 26-28% reduction in eCO_2 emissions by 2025 (Figure 3.5).

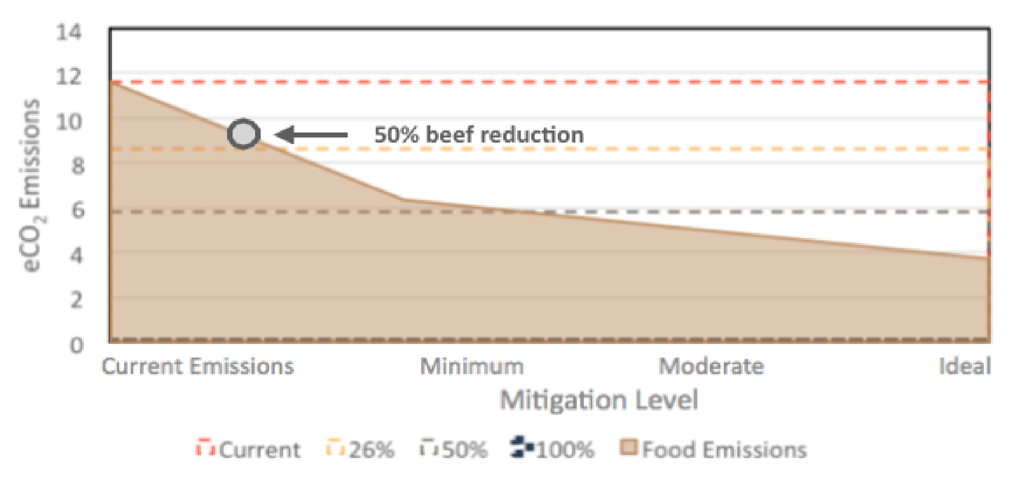


Figure 3.5: The contribution of 50% beef reduction in meeting our Minimum, Moderate, and Ideal Goals (eCO_2 emissions in metric tons)

Education, Individual Action & Role of FUS

In order to meet our climate action goals, individuals on FUS's campus will need to change their current food consumption patterns. Encouraging behavior change may seem like a daunting task, but it can be achieved through educational means. The most effective mitigation strategies are those which allow individuals to develop their understanding of food's impact on the climate together in dialogue (De Witt, 2016). Events like Meatless Monday and informational movie screenings followed by discussion are an effective means for introducing the idea of food-related carbon neutrality at FUS. Further, we suggest that individuals at FUS increase their personal offsets by setting reminders on the FUS App to bring reusable mugs and containers to the dining halls, and to compost their food waste more frequently.

4. Mitigation Strategy: Energy Usage

Climate and Energy

It is FUS's responsibility to reduce fossil fuel related greenhouse gas emissions through the provision of renewable energy via the solar panel project. In a changing climate, using solar energy technologies instead of fossil fuel-intensive technologies is extremely effective in mitigating the effects of climate change. Of these existing technologies, the most common is solar panels (IPCC, 2011). Solar energy production can reduce our carbon footprint and limit the emissions of pollutants such as particulate matter, sulfur oxides, and noxious gases that would have otherwise been released into the atmosphere. By reducing these emissions, we minimize the frequency of anthropogenic events with adverse effects on the environment, such as acid rain. Our goals, displayed in Table 4.1, take into account the actions already underway at FUS as the data indicate that our current solar energy production meets our Minimum Goal. Our Moderate and Ideal Goals can each be addressed through additional solar panel provision on the FUS campus.

Goal Statement: 100% renewable energy through the solar panel project

Goals	**Solar Energy**	**Associated climate action goals**
Minimum	SP 0, current solar panels	26-28% reduction in eCO_2 emissions by 2025
Moderate	SP 1-4	50% reduction in eCO_2 emissions by 2030
Ideal	SP 1-8	100% reduction in eCO_2 emissions by 2050

Table 4.1: Our suggested goals for reducing FUS's emissions through solar energy mitigation strategies.

Franklin University Switzerland and Solar Energy

In 2018, FUS invested in a solar panel project. The university partnered with the local Ticinese utility company, Aziende industriali di Lugano (AIL), to reduce eCO_2 emissions on campus while meeting growing energy needs. After entering in a twenty-year contract with AIL, FUS installed 152 solar panels on top of two of its buildings: New Residence A and New Residence B (Figure 4.1). The contract states that any energy produced beyond what is consumed by the university is added to the local electrical grid, which will then work as a carbon sink until the twenty-year contract is completed. After the twenty-year contract, FUS may sell any surplus energy generated sold to the electrical grid. Earnings from this can then be used to buy carbon offsets for future travel-related activities, taking FUS one step closer to carbon neutrality.

Figure 4.1: The 152 solar panels on New Residence Buildings: A &B (AIL, 2019)

Current Efforts

Emissions from electricity production account for about 1% of FUS's total eCO_2 emissions. In 2018, the institution consumed about 675,000 kilowatts of electrical energy. This 1% of eCO_2 emissions makes up a minuscule part of FUS's carbon footprint (Figure 4.2) because FUS draws its electricity from the Ticinese electrical grid, about 68% of which is derived from renewable energy sources, such as hydropower.

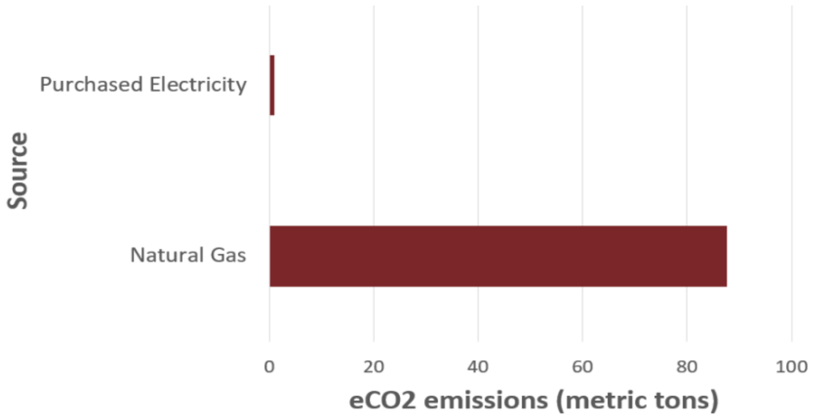


Figure 4.2: eCO_2 Emissions from Electricity and Natural Gas

The 152 solar panels began contributing to the electrical grid on 7 December 2018. The current solar panel project is expected to generate about 51,000 kilowatt-hours of energy annually, preventing a projected 25.2 metric tons of CO_2 from being released into the atmosphere per year (AIL, 2019). Figure 4.3 shows the year-to-date electricity production, by month, of the current solar panel project. March has been the most productive month, generating a total of 5,460 kilowatts (AIL, 2019). The months of the year with the greatest amount of sunshine, June and July, will generally generate the most electricity.

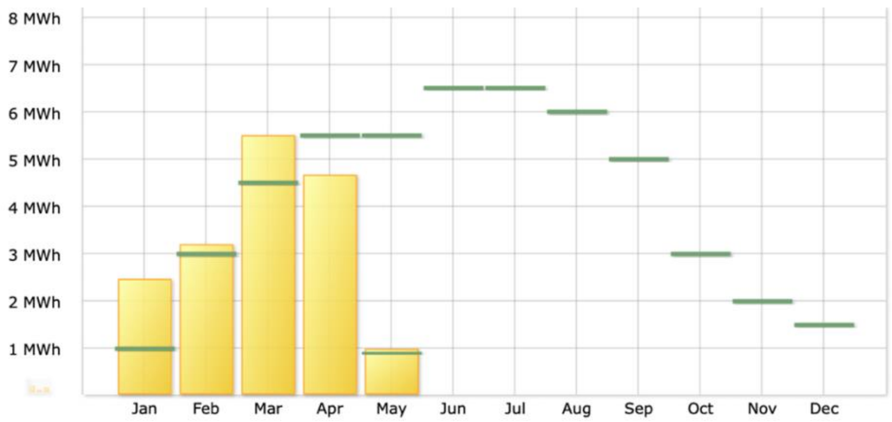


Figure 4.3: Monthly overview of solar panel energy production from 01.01.2019 - 05.05.19
The green dash represents the expected monthly production based on climate averages. The chart represents data that change by the minute (AIL, 2019).

The available data only represent a small fraction of what the solar panels will contribute over time. As of 4 May 2019, electricity generated from FUS's current solar panels has already prevented 12.62 metric tons of CO_2 emissions released into the atmosphere (AIL, 2019). For this reason, we are interested in increasing the scope of renewable energy projects at FUS, specifically through the implementation of solar panels.

Recommended Actions

The environmental contribution of solar energy at FUS could be increased eleven-fold with the addition of eight more suitable solar panel projects on campus. Table 4.2 defines the eight recommended locations for the expansion of the solar energy project (SP 1-8) and includes the pilot solar panel project, New Residence A and B (SP 0). We measured the suitability of the various proposed locations using a solar energy potential analysis that is carried out by Meteotest and provided by the Swiss Federal Office of Energy (SFOE, 2019). The solar energy potential analysis measures the suitability of roofs and facades for solar power using the location's exposure to solar radiation, orientation, and pitch. We used the analysis to calculate the suitability of SP 2, 3 and 8. We estimated the non-rooftop locations of SP 1,5 and 6 by measuring the closest building to the location. We only recommend locations that are of high or very high suitability for solar energy potential.

Using the methods described above, we estimated the expected energy production for SP 1-8 in comparison with actual energy production from SP 0. Additionally, we calculated the expected the carbon offset potential using the proportion of SP 1-8 and the pilot project's expected annual metric tons of carbon offset. Refer to Appendix E for more detailed information regarding the recommended solar panels. The results of SP 1-8 expected annual energy production and carbon offset are shown in Table 4.3.

Solar Panel	Location	Suitability of Solar Panel Location
SP 0	New Residence A and B	Very High
SP 1*	Soccer Field	Very High
SP 2	LDV Residential Building	Very High
SP 3	Panera Residential Building	Very High
SP 4	Parking Lot Next to Panera Residential Building	Very High
SP 5*	Main Student Parking Lot	High
SP 6*	Parking Lot Between Main North Villa and Lab Building	High
SP 7	Green Space Above South East Parking Lot	Very High
SP 8	Lower Academic Building (not in shade)	High

Table 4.2: Locations and suitability of solar panels (NREL, 2019)

* Meteotest tool could not measure the suitability of these locations because they are not roofs or facades. We measured the suitability of these locations using the suitability of the nearest building.

Projections

The analyses shown in Table 5.3 suggest that the eight recommended solar panel locations and the current pilot project could offset a total 315.3 metric tons of eCO_2 annually. This correlates to a 53% annual reduction in FUS's academic travel carbon footprint, or a 9% annual reduction in FUS's total carbon footprint. Box 4.1 expands on how the solar panel projects, grouped according to our goals, can offset FUS's total carbon footprint. See Table E4 for the total cost of each individual SP 1-8.

Solar Panel	Expected Energy Production (kWh/Year)	Solar Radiation (kWh/ m^2 /year)	Expected Carbon Offset (metric tons/year)
SP 0	51,000	3.10	25.2
SP 1	309,000	3.21	153
SP 2	49,800	3.10	25.1
SP 3	68,900	3.10	33.9
SP 4	28,600	3.10	14.04
SP 5	45,900	3.10	22.7
SP 6	23,700	3.10	11.7
SP 7	10,100	3.21	5
SP 8	49,900	3.10	24.7
TOTAL	**636,900**	-	**315.3**

Table 4.3: Proposed solar panel locations' expected energy production and carbon offset (AIL, 2019)

Box 4.1: How Much the Recommended Solar Panels Can Reduce Franklin's Carbon Footprint and Associated Costs

Solar Panel	Percentage offset for Franklin's *Total Carbon Footprint*	Percentage offset for *Directly Financed Travel* Carbon Footprint	Percentage offset for *Academic Travel* Carbon Footprint
SP 0	0.70%	3.00%	4.25%
SP 1-4	6.27%	26.85%	38.01%
SP 1-8	8.05%	34.49%	48.83%

- SP 1-4: Approximately CHF 67,000
- SP 5-8: Approximately CHF 19,000
- SP 1-8: Approximately CHF 86,000

Goals

FUS already meets our Minimum Goal with its current solar panels (SP 0). The implementation of the first recommended set of solar panels, 1-4, FUS would exceed the Moderate Goal. Through the implementation of all proposed solar panel locations, SP 0-8, FUS could produce enough energy to offset emissions from other activities (Figure 4.4).

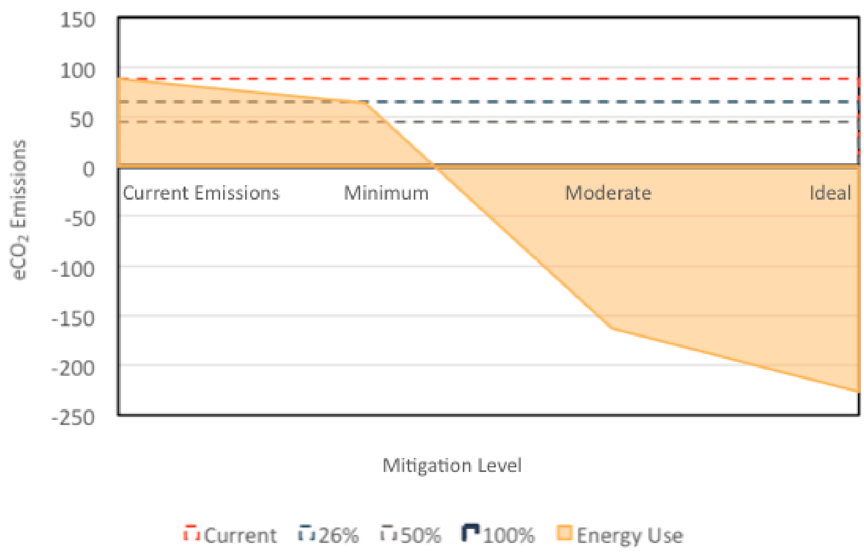
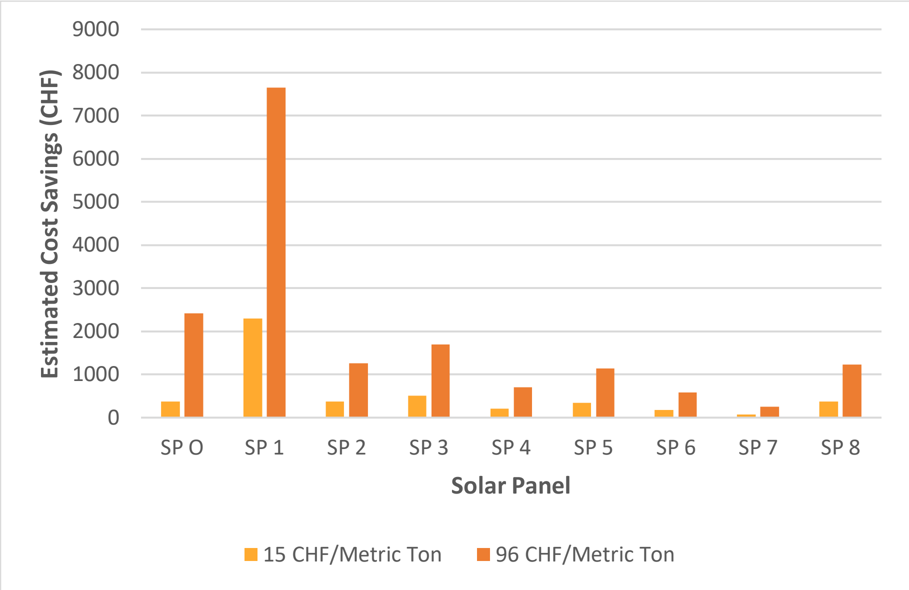


Figure 4.4: Contribution of Solar Panels 1-8 to our Minimum, Moderate, and Ideal Goals (CO_2 emissions in metric tons).

As Figure 4.4 shows, about 300 metric tons of CO_2 would be offset with the implementation of SP 1-8. Ideally, FUS could contribute the additional 200 metric tons (after energy offset) to travel-related activities as a primary offset. As Figure 4.5 displays, SP 0, the current pilot solar panel project, will contribute a high-end estimate of about 2,400CHF annually toward offsetting FUS's emissions, as determined using the Swiss mandated cost for one metric ton of carbon dioxide of 96CHF (Box 5.2). SP 1, the soccer field, would contribute the highest estimated savings at 7,650CHF annually. SP 2-8 and SP 0 would contribute a savings of about 6,800CHF annually. This long-term investment would be beneficial for FUS in reducing the carbon footprint of energy consumption alongside the large travel carbon footprint of Academic Travel.



Box 4.2: Carbon Offset Price Points Based on US and Swiss standards

15 CHF per metric ton

In early 2019, Washington state lawmakers proposed a ballot measure to institute a statewide carbon tax of 15 CHF per metric ton (Lam, 2019).

96 CHF per metric ton

Swiss law sets the price of offsetting one metric ton of CO_2 at 96 CHF (FOEN, 2018).

Figure 4.5: The costs of purchased offsets for the equivalent amounts of offset CO_2 emissions by each solar panel, corresponding with offset prices of 15 CHF and 96 CHF per metric ton of CO_2

Education, Individual Action, and the Role of FUS

FUS can fulfill its social responsibility to mitigate climate change by educating its community on how to be efficient with energy production on campus. If FUS can influence its community to have greater awareness of its electricity consumption, the institution will produce direct benefits for the institution and greater community. Individuals will feel encourage to have more sustainable energy consumption habits in the future, and FUS will eventually have the opportunity to sell surplus electricity to the grid. Box 4.3 provides recommendations that apply to individuals and the institution. By following these recommendations, FUS can greatly reduce its total electrical consumption. This can be achieved through student-led discussions, marketing, posters, social media, and the FUS App. We suggest that FUS include these recommendations in orientation, so that all incoming students are able to adopt sustainable personal habits early in their FUS career. This gives the university a way to not only reduce its carbon footprint, but to provide students with knowledge that they can carry with them into the world.

Box 4.3: Recommended Actions for Energy Efficiency

- Infrastructure
  - Installing skylights and windows in new buildings
    - Reduces the need for electrical light
  - Green roof or solar panels on roof
- Equipment
  - Energy efficient machines: washing machines, dryers, fridges, stoves etc.
  - Efficient shower heads
    - Reduces electrical energy used during water heating
  - Motion sensing lights
- Behavior
  - Turning off equipment when not in use
  - Avoid turning on lights during the day
  - Air drying laundry
- Education
  - Posters of social awareness about conserving energy
  - Lecture on sustainable energy usage during orientation

5. Mitigation Strategy: Directly Financed Travel Emissions

Climate and Travel

It is FUS's responsibility to make its directly financed travel carbon neutral by the year 2050. Directly financed travels account for 21% of FUS's total emissions (Figure 2.2, page 16) and includes FUS's Academic Travel program, faculty and staff commutes, and other directly financed travel, such as Office of Student Life (OSL) events, admissions-related travel, and conferences. However, all travels from the FUS President, Board of Trustees, Advancement, and alumni are not included. Thus, the results that we calculated are an underestimation of the travel-related eCO_2 emissions.

Goal Statement: 100% carbon neutral travel by the year 2050

Goal	**Travel**	**Associated Climate Action Goals**
Minimum	Use of direct flights for the 6 highest-emitting academic travel courses	26-28% reduction in eCO_2 emissions by 2025
Moderate	Minimum Goal + offsets from installation of SP 1-8	50% reduction in eCO_2 emissions by 2030
Ideal	Minimum and Moderate Goals + additional purchased offsets	100% reduction in eCO_2 emissions by 2050

Table 5.1: Our suggested goals for reducing FUS's emissions through travel mitigation strategies.

Academic Travel is extremely important in this analysis, as it accounts for 69% of FUS's directly-financed emissions, whereas faculty and staff commute accounts for 9% and other directly-financed travels account for 4% (Table 5.2). Academic Travel is an integral part of the core curriculum, culture, and learning experience at FUS, meaning it is essential that we rethink it in a more sustainable way. Overall, Academic Travel covers more distance by plane than by other mode of transport, and air travel emits the most eCO_2 (Table 5.3).

Travel Component	**Metric tons of eCO_2**	**Percentage of FUS's carbon footprint**

Academic Travel	594.28	69%
Faculty and staff commutes	79.65	9%
Other directly financed travels	37.15	4%

Table 5.2: Each travel component's contribution to FUS's directly-financed carbon footprint

Mode of Transportation	KM Traveled	Travel Emissions (eCO_2)
Air Travel	2,905,880.60	561.50
Bus Travel	48,212.40	29.34
Train Travel	193,513.60	3.45

Table 5.3: Academic Travel emissions and kilometers traveled by each mode of transport

Current Efforts

The purchase of third-party offsets can be used to mitigate the effects of FUS's travel-related emissions. Out of 27 Academic Travel courses offered in the year 2018, only one academic travel leader used a third-party to offset emissions from the travel course. The offset invested in reforestation efforts and will offset approximately 200 metric tons of CO_2 over a 50-year period (B Hale 2019, personal communication, 3 April). Third-party offsets are a noteworthy way to offset travel emissions; however, individuals can also take actions to reduce the impact of their own travel habits. Lastly, FUS's solar panel project can be used to offset emissions and to eventually achieve carbon neutrality.

Goals: Academic Travel Mitigation

Our Minimum Goal, a 26-28% reduction in GHG emissions by 2025, can be achieved if all travel courses solely utilize direct flights. For example, the top six emitting Academic Travel courses account for approximately 68% of total academic travel emissions, which amounts to 406.23 metric tons of eCO_2 (Table 5.4). If these six courses take direct flights, it would reduce their eCO_2 emissions by about 45%, bringing FUS slightly beyond our Minimum Goal (Figure 5.1). Direct flights out of Milan Malpensa Airport (MXP) or Zurich International Airport (ZRH) are available for all six travels. If each of the six highest eCO_2 polluting travel courses takes a direct flight and FUS installs solar panels 1-8, FUS can exceed its Moderate Goal. By taking both steps, referred to as our first-party offsets, plus purchasing third-party offsets, FUS can achieve its Ideal Goal (Figure 5.1). Carbon offsets can be purchased using a Carbon Offset Fund (see pages 38-39).

Travel Location	**Current Travel Patterns (Connecting Flights)** eCO_2 from Flights (metric tons)	**Proposed Travel Patterns (Direct Flights)** eCO_2 from Flights (metric tons)
Johannesburg/Botswana/Zimbabwe	107.27	77.79
Rishikesh/ Bhutan	79.55	2.38
South Africa/Swaziland	149.96	86.91
Tbilisi/Baku	33.82	31.92
Porto/Lisbon/Belem	21.04	15.11
Andalusia	14.59	10.24
Total eCO_2	**406.23**	**224.35**

Table 5.4: Comparison of eCO_2 emissions of current and proposed flight patterns (adjusted flight paths using emissions coefficients for air travel)

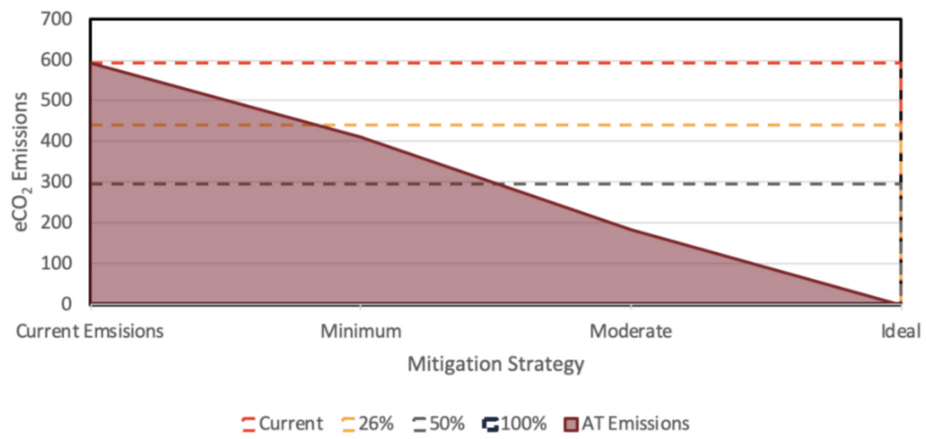


Figure 5.1: The contribution of travel mitigation strategies in meeting our Minimum, Moderate, and Ideal Goals for Academic Travel (eCO_2 emissions in metric tons)

Goals: All Directly-Financed Travel

It is also important to mitigate emissions from other forms of directly-financed travel, such as staff and faculty commutes, OSL events, admissions-related travel, and student, staff, and faculty conferences. Figure 5.2 demonstrates how emissions for all remaining directly-financed travel, including Academic Travel emissions left after first-party offsets, can be addressed through third-party purchased offsets.

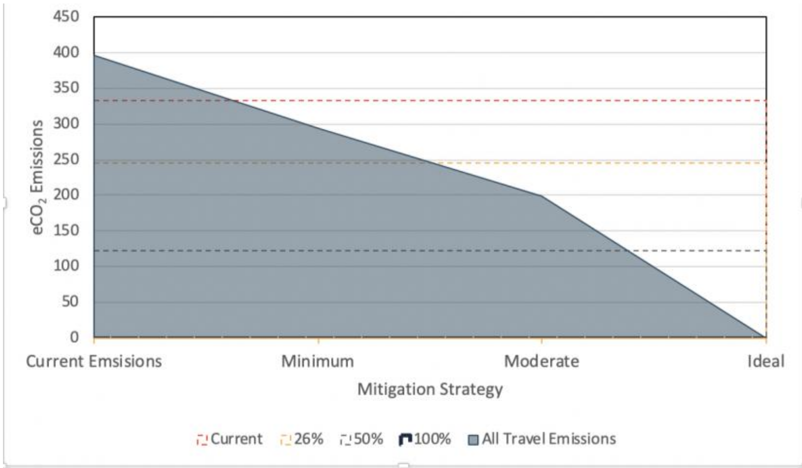


Figure 5.2: The contribution of travel mitigation strategies to contribute to Minimum, Moderate, and Ideal Goals for all directly financed travel (eCO_2 emissions in metric tons)

Carbon Offset Fund

Many organizations make use of carbon offsets to counteract their emissions. Globally, treaties and legal frameworks establish the "carbon market," which is composed of a regulatory and voluntary network of members (Gossling et al. 2007). In the European Union the carbon market functions by administering a carbon allowance to companies. These companies must purchase Emissions Reduction Units (ERUs) or perform approved internal projects in order to exceed that allowance. The purpose of this is to utilize market mechanics to incentivize the reduction of emissions while accurately reporting all emissions which are in excess of the project's objectives. Beyond the regulatory market, a voluntary market also exists. It comprises of private actors who perform external auditing of projects. They occasionally hold higher standards than the regulatory market for offsetting investments (Gossling et al. 2007). FUS, which is not bound by a regulatory framework, may consider investing in the reduction of emissions though the voluntary market in order to offset the environmental consequences of air travel. Investments in third-party offsets can promote a large variety of projects in different sectors. Due to the popular approach of investing in reforestation and afforestation efforts, Gossling and Peeters (2007) predict that by the year 2050, the available land space for such efforts will no longer exist. Therefore, the investment in alternative methods of carbon offsetting may be preferable in the long run.

While the aforementioned first-party offset strategies are designed to minimize FUS's carbon footprint, these pathways are not enough to achieve carbon neutrality. We can use purchased third-party offsets to address the remainder of FUS's travel emissions. To achieve this goal, as a supplement to academic travel budgeting adjustments, we propose the foundation of a donation fund dedicated to achieving carbon neutrality. Alumni and other potential donors could contribute to FUS's climate goals by donating to this fund. As there is no single standard for carbon offset pricing, to calculate the projected costs of offsetting all directly financed travel, we applied the two price standards outlined in Box 4.2. We calculated the cost ranges of third-party offsets for each of the three levels of mitigation, with and without the inclusion of first-party offsets, to establish a price range which can be utilized for decision-making in the implementation of first-party mitigation strategies for these travels. Figure 5.3 shows the average of these cost estimates, while specific cost estimates for the two price standards are shown in Figures F3 and F4, and Tables F3 and F4 (Appendix F).

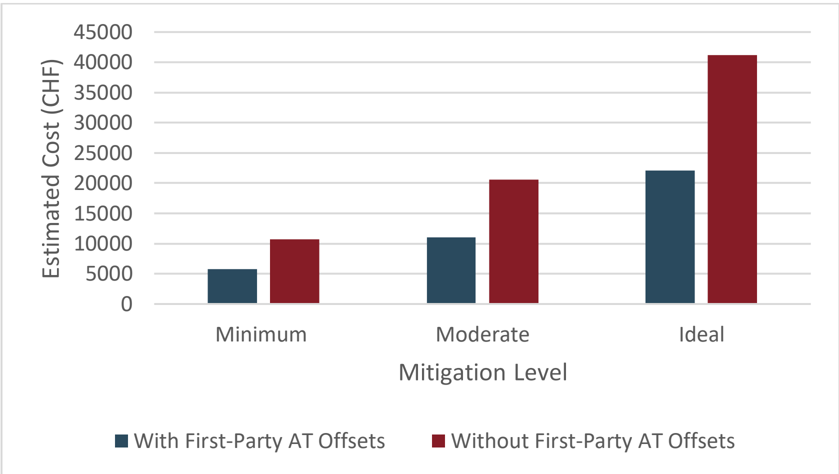


Figure 5.3: Average total cost of third-party offsets for all directly financed travel emissions, with and without the implementation of first-party offset strategies for academic travels

Individual Action

It is FUS's responsibility to recommend actions for individuals which encourage them to reduce their eCO_2 emissions (Box 5.1). The remaining 77% of FUS's emissions derive from indirect sources. Student traveling to and from their home countries each semester emits approximately 1801.2 metric tons eCO_2, comprising 50% of FUS's total emissions. Meanwhile, family travel to Lugano, Switzerland for the graduation ceremony accounts for approximately 960.16 metric tons eCO_2, which accounts for 27% of FUS's overall emissions (Figure 2.2, page 16). By addressing individual responsibility to adhere to sustainable practices, FUS can reduce its indirectly- and directly-financed impacts. As discussed further in the Education, Research and Community Outreach section, FUS is in an ideal position to encourage sustainable action campus-wide.

Box 5.1: Recommended Actions for Sustainable Travel Franklin Could Take

- Purchase third-party offsets
    - Encourage families traveling for graduation to offset their flights
- Reduce reliance on conferences abroad
    - Improve access and availability of video conferencing capabilities
    - Prioritize local conferences
- Encourage individuals to support carbon reduction projects abroad
    - Shop at cooperatives, small businesses, and marketplaces
    - Book sustainable accommodations such as hostels with official ecolabels*, bed-and-breakfasts, campsites, or homestays

*We recommend booking accommodations certified by the EU ecolabel to ensure that at least 50% of the electricity used on site comes from renewable energy sources [I].

6. Education, Research, and Community Outreach

The Role of the University in Combating Climate Change

As centers of knowledge, institutions of higher education (IHEs) are in an ideal position to enhance understanding about climate change. Given their use of natural resources, energy consumption, waste generation, and overall environmental impact, universities resemble "real world communities;" they are also institutions of learning, problem-solving, and innovating (Hale and Vogelaar, 2015, p. 185). In their studies, Rowe (2002), Beringer and Adomßent (2008); and Way et al. (2012) argue that because of these characteristics, IHEs are optimal locations for incorporating sustainability initiatives into all university levels (studies cited in Hale and Vogelaar, 2015). Sustainability is defined as the ability to meet our own needs without hindering the ability of future generations to meet theirs (WCED, 1987). This definition encompasses the ability to mitigate climate impacts. In the literature, there are four main areas where sustainability can be integrated into universities: education, research, operations, and outreach (Ralph & Stubbs, 2014). The mitigation strategies cover campus operations, so in this section of the paper we will look at education, research, and outreach. In this section, we also cover recommended strategies to enhance sustainability efforts in each of these areas (Box 6.1).

Box 6.1: Overview of Recommended Actions for Integrating a Whole-of-University Approach at FUS

- Education
    - General Curriculum
        - Introduce a core requirement that fosters sustainability literacy
        - Create an interdisciplinary, research-based capstone "topic" that several disciplines can participate in
    - Academic Travel Curriculum
        - Implement an educational component for each travel course
        - Implement sustainability training for each travel leader
- Research
    - Continue research into FUS's carbon emissions and potential mitigation strategies
        - Create an interdisciplinary, research-based capstone "topic" that several disciplines can participate in
- Community Outreach
    - Design a Living and Learning Community dedicated to sustainability
    - Expand the Center for Sustainability Initiatives into a Green Office

A whole-of-university approach recognizes the importance of integrating sustainability and climate-friendly initiatives across all university levels (Mcmillin and Dyball, 2009). In universities, there is a frequent disconnect among the curriculum, research, and its operations. Separate entities frequently control these areas, and therefore, they operate independently of each other (Mcmillin and Dyball, 2009). Figure 6.1 shows that under a whole-of-university approach, these areas work synergistically to create a living example of sustainability in higher education institutions. We advocate that FUS uses this approach as a backdrop for implementing sustainability measures.

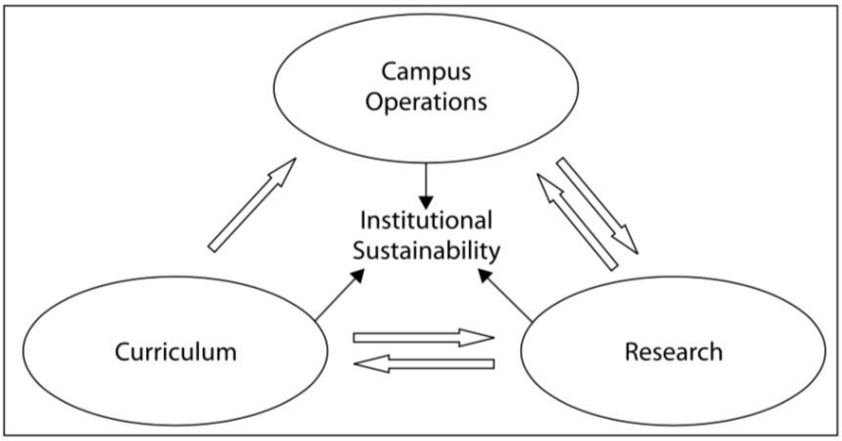


Figure 6.1: Depiction of the synergetic flow between curriculum, campus operations, and research in a whole-of-university approach (McMillin & Dyball, 2009)

Integration of sustainability into every level of the university is important because it allows students, staff, and faculty to understand how an institution can serve as a model for sustainability. Students do not learn solely within the classroom; there are also lessons to be learned from a university's principles and campus management. "Latent" curriculum refers to the education that students receive from the institution itself, but outside of the traditional classroom setting (Rowe, 2002). Students experience this type of learning through campus involvement and the real-world knowledge that they gain by learning about their campus's operations, which provides them with the opportunity to conceptualize how sustainability can come to fruition in the real world. Educational programs also provide experiential opportunities for students to gain real world knowledge through their engagement with the onsite location (Dvorak et al., 2011). At FUS, the Academic Travel program is an example of how latent learning can occur. Through the program, Franklin has the unique opportunity to spread sustainable practices beyond campus via its student body of international travelers (Brubaker, 2006; Lutterman-Aguilar and Gingerich, 2002; Paige et al., 2009; Tarrant, 2010 as cited in Hale et al., 2013). By implementing a whole-of-university approach, FUS can serve as an effective role model for sustainability. An individual's environment molds their habits, thus the creation of a space which empowers students to live as environmentally-conscious global citizens fosters long-lasting environmentally-friendly habits (Ciotti, 2014). It is also important to note that through their multiplier effect, universities have enduring impacts on their communities (Ralph & Stubbs, 2014). In terms of sustainability, a multiplier-effect manifests itself in the real-world actions that students and graduates take with them to promote sustainable societies in the future.

To implement a whole-of-university approach, FUS can refer to the Talloires Declaration (1990). This declaration provides basic guidelines about how to integrate "the sometimes vague concept of sustainability" into educational institutions (McMillin & Dyball, 2009, p. 56). To adopt the declaration, a university must obtain the president's signature and either send or email a scanned PDF of the signatory form to the Association of University Leaders for a Sustainable Future (ULSF, 2015). The signatory form is available on the organization's website. Adopted by several universities around the globe, the 10-point action plan is as follows (ULSF, 1990):

1.) Increase awareness of environmentally sustainable development

2.) Create an institutional culture of sustainability

3.) Educate for environmentally sustainable citizenship

4.) Foster environmental literacy for all

5.) Practice institutional ecology

6.) Involve all stakeholders

7.) Collaborate for interdisciplinary approaches

8.) Enhance capacity of primary and secondary school

9.) Broaden service and outreach nationally and internationally

10.) Maintain the movement

Each of these 10 points can be applied to at least one of the three areas of sustainability integration: education, research, and community outreach. While each individual point helps contribute towards a whole-of-university approach, some relate more directly to one of the above-mentioned key areas. Points 1, 3, 4, and 7 all relate to education, point 8 relates to research, points 6 and 9 relate to community outreach, and points 2, 5, and 10 are essential for a fully integrated, synergetic approach to sustainability. To clarify some of the terms in the points, environmentally sustainable citizenship is defined as pro-environmental behavior that is associated with the development of solutions for environmental issues on local, regional, national, and global scales (Cao, 2018). Environmental literacy is defined as the "knowledge, skills, and mindsets that allow individuals to become deeply committed to building a sustainable future and assisting in making informed and effective decisions to this end" (UNDESA, 2019).

Education and Curriculum

Where we are now?

Currently, the FUS general curriculum includes several sustainability and climate-change related courses across all disciplines. FUS has two major tracks, Environmental Studies (ENV) and Social Justice and Sustainability (SJS), that are heavily centered on climate-change related themes. Many courses across all disciplines emphasize interdisciplinary education and incorporate research into their curricula. In this way, FUS captures a whole-of-university approach through the connection of curriculum, research, and operations. Students become involved in efforts to make the campus more sustainable and can understand the real-world application of their work. According to McMillin and Dyball (2009), this approach to education and curriculum provides practical working skills that can be put into action, promotes whole systems rather than fragmented thinking, and encourages "environmentally-responsible citizenship (62)."

FUS currently offers 67 interdisciplinary courses (see Appendix G for methodology and a list of courses) that express a clear connection to environmental, economic, or socio-cultural sustainability in their course description. Of these, 24 courses use the words "sustainable," "sustainability," or "climate change" in their title or description (Appendix G) (FUS, 2018). These courses span disciplines such as Art History, Communications, Economics, Political Science, and Visual Communication Arts. Seventeen of these courses include an Academic Travel component. From this inventory, it becomes clear that FUS offers an interdisciplinary curriculum, which is integral for addressing the multi-dimensional consequences of climate change (McMillin and Dyball, 2009). While these courses openly state their focus on sustainability, there are likely many more that address climate change and/or sustainability in their course material without explicit statement in their course descriptions. We were therefore unable to include these courses in our analysis.

Recommended Actions for Integration of Sustainability into Education

Core requirements at FUS are part of the core curriculum. They allow students to engage with and develop skills in multiple key areas of a liberal arts education, including quantitative reasoning, writing, modern language, and global responsibility. The Academic Travel program is also a part of the core curriculum, and will be discussed in the next section, titled "Teaching (and Traveling) Sustainably." In terms of global responsibility, there are three areas of study that satisfy this requirement: intercultural competency, international engagement, and social responsibility. FUS requires students to take 6 credits in each of these three areas, meaning that the global responsibility requirement consists of 18 credits in total. Within global responsibility, there is potential to incorporate an interdisciplinary, sustainability-centered core requirement. While social responsibility already entails a minor sustainability element, it is not the focus of the requirement. A "sustainability literacy" requirement can become the fourth component of global responsibility and be comprised of 3 to 6 credits. By making sustainability a core requirement, FUS will demonstrate its commitment to educating students about one of the most pressing global issues that the world faces today. As learning institutions that are ripe with knowledge, universities have an "ethical obligation" to provide students with knowledge about climate change (Ralph and Stubbs, 2014, p. 74). The courses to satisfy a "sustainability literacy" requirement can be broad in nature, but they should explicitly engage with the three main pillars of sustainability: economic, environmental, and socio-cultural. These three pillars refer to maintenance of a steady economy, management of ecosystems and species, and sustenance of a high quality of life (Long et al., 2013; Brown et al., 1987). This requirement should also be solution-oriented to provide students with real-world understanding of how they can create change in their own lives and on a larger scale.

Further, FUS can introduce an interdisciplinary, research-based capstone "topic" of the year. By creating an overarching "topic" for the capstone, individual departments can choose whether they want to partake in the topic. This "topic" can explore the multidimensional impacts of climate change while simultaneously looking for ways to address it. Coursework and research within each discipline's capstone should also apply directly to FUS's campus culture and operations. Potential areas for exploration include:

- Identifying how FUS can benefit from marketing its commitment to sustainability and creating materials for distribution
- Assessing current business operations and identifying opportune areas to implement policies that enhance Corporate Social Responsibility
- Exploring on-campus and/or local attitudes and beliefs towards climate change and sustainability
- Data collection and analysis regarding FUS's climate and ecological impacts
- Designing more sustainable methods of living on campus
- Exploring behavioral change and the dissemination of information regarding sustainability
- Case studies of the environmental, economic, and socio-cultural impacts of certain travel courses

These potential areas for study are all related to FUS's own campus culture and operations, which would help students conceptualize and apply their studies to real world scenarios. While the capstone is intended to "cap off" a student's respective area of study, sustainability is an inter-disciplinary concept that allows for diverse topics of research. Each of the potential areas of study presents the ability for several capstones to collaborate on their findings, which promotes a sense of community among all participants. Students would be able to collaborate, support each other's work, and work together to provide multidimensional solutions to sustainability-related issues. To further contribute to an interdisciplinary approach, the individual capstone courses can be scheduled at the same time so that professors can hold classes together. Courses can also feature guest lectures from other professors. In the future, an interdisciplinary capstone "topic" can also pave the way for creating a single interdisciplinary capstone course. For this course, professors from different disciplines could co-teach the course and collaborate on a sustainability-themed research topic.

Teaching (and Traveling) Sustainably:

Academic Travel is also a central characteristic of FUS's culture and curriculum. The program is based on the concept of experiential learning, in which students travel to an onsite location to learn about a subject in depth (FUS, 2019a). According to FUS's mission, "A FUS education produces critical thinkers who are culturally literate, ethically aware and intellectually courageous. [It] prepare[s] students to become responsible, compassionate, and collaborative leaders in an increasingly complex and interconnected world" (FUS, 2019e). Travel programs help strengthen the global citizenship of students by making them socially, politically, and culturally aware (Tarrant and Lyons, 2012); however, with being a global citizen comes the responsibility to respect local cultures and to limit one's harm on the natural environment (Oxfam Education, 2019). In general, universities often avoid discussion of sustainability when it comes to their educational travel programs. Reasons for the omission of sustainability include limited budgets and lack of information regarding sustainable travel (Hale et al., 2013). Thirteen of FUS's Academic Travel courses focus explicitly on sustainability; however, modern travel is often inherently unsustainable due to reliance on flights. It can be paradoxical to teach courses surrounding sustainable development and climate change while simultaneously engaging in activities that emit large amounts of GHGs. While the Academic Travel Mitigation section of this paper focuses on how to make traveling more sustainable, it is also important to implement an educational component in the curriculum about how to travel sustainably.

Recommended Actions

Academic Travel courses should outline goals to teach students about sustainability within and beyond the travel component (Hale et al., 2013). For this reason, we suggest implementing an educational section regarding sustainability in each travel class. Incorporating sustainability measures into travel curricula can not only help students adopt more sustainable lifestyles, but also establish good relationships with local communities. This educational component should address both individual tips for sustainable travel and location-specific tips as they apply to the travel destination. Refer to Box 5.1 (p. 41) for travel tips that apply to individuals and groups. In terms of educating individuals about the specific location of their travel program, course activities can include a carbon footprint analysis of the destination, brainstorming for how to reduce this impact, and research about the local practices and policies regarding environmental protection.

To ensure that travel leaders are versed in the integration of a sustainability component to their travel courses, we suggest implementing sustainability training for all faculty who lead a travel. This training can be led by the Center for Sustainability Initiatives (CSI) and it can focus on how to choose a location, how to travel there, and how to take sustainable actions while there. Location choice should not be underestimated since site is one of the most important decisions that can be made while designing a sustainable travel program (Hale and Vogelaar, 2015). Even if some locations do not have infrastructure that is compatible with sustainability, they can provide grounds for discussing sustainability challenges with respect to development. Providing education about sustainable travel is imperative because all travel has ecological impacts. As an international university situated in the heart of Europe, FUS inspires many people to travel. Whether it be staff and students who travel independently during the semester or friends and family who visit FUS, travel is integral to Franklin's culture. By potentially changing student and staff behavior in regard to commuting habits, sustainability training can help reduce the ecological and social impacts of travel while offsetting some of FUS's non-directly financed emissions. Here, it is important to note that encouraging students to take fewer flights home may have an adverse effect because it can encourage family and friends to visit the student on campus (Davies and Dunk, 2015). Instead of encouraging students to take fewer flights to and from home, sustainability education can incentive students to think about and reassess the need for weekend trips during their time at Franklin. Franklin's multiplier effect can appear through the proliferation of these real-world actions.

Research

Where we are now and Recommendations

Current research through FUS is limited to individual professors' projects and their research assistants. Students may conduct research as a supplement to their own major studies, and many courses at FUS require students to conduct research as a part of the curriculum. As a liberal arts university, FUS can excel in producing interdisciplinary research about the socio-cultural and economic impacts of climate change. In the classroom, students can also investigate sustainability as it applies to campus life and operations, which the university can then utilize. We recommend that the research that we have conducted into FUS's carbon dioxide emissions and mitigation strategies be continued in the future. More information about how to further this research can be found in the "Tracking Progress" section of this report. To enhance student research in terms of sustainability, we also recommend the implementation of a sustainability-themed capstone "topic," as addressed above in "Recommended Actions" for "Teaching and Traveling Sustainably."

Community Outreach

Where we are now?

While knowledge is an important first step for promoting behavioral change, it is not enough. Encouraging long-lasting behavioral change requires engagement with and support from the community (Too and Bajracharya, 2015). The 6-P community engagement framework, created by Too and Bajracharya (2015), highlights six central components for getting more individuals involved in community outreach programs (Figure 6.2). While FUS is already home to several community outreach programs, this framework can be used to strengthen their impact. At FUS, community outreach efforts include the Center for Sustainability Initiatives (CSI), Sustainability Week Lugano (SWL), and the FUS Sustainability Club and garden. CSI is a faculty and student-led organization that educates and encourages the FUS community to live more sustainably (FUS, 2019c). It has partnerships with Swiss NGOs ProNatura TI, Protect Our Winters, and Sustainability Week Switzerland, all of which allow members of FUS to connect with the Swiss community. Establishing a network for sustainability efforts among universities is an important factor for integrating sustainability into IHE (Velazquez et al., 2006, as cited in Too and Bajracharya, 2015); FUS's new student-led initiative, Sustainability Week Lugano, is a partnership with two local universities: USI and La Scuola Universitaria professionale della Svizzera italiana (SUPSI). Furthermore, FUS's Sustainability Club started in 2017 and leads several educational events about sustainable living. Events include clothing swaps, movie screenings, workshops, and events in the on-campus sustainable garden. The on-campus garden is managed largely by students and utilizes compost, which is a carbon sink. By using the 6-P framework for community engagement, these student and faculty-led organizations can enhance their outreach initiatives and encourage members of the community to live more sustainably.

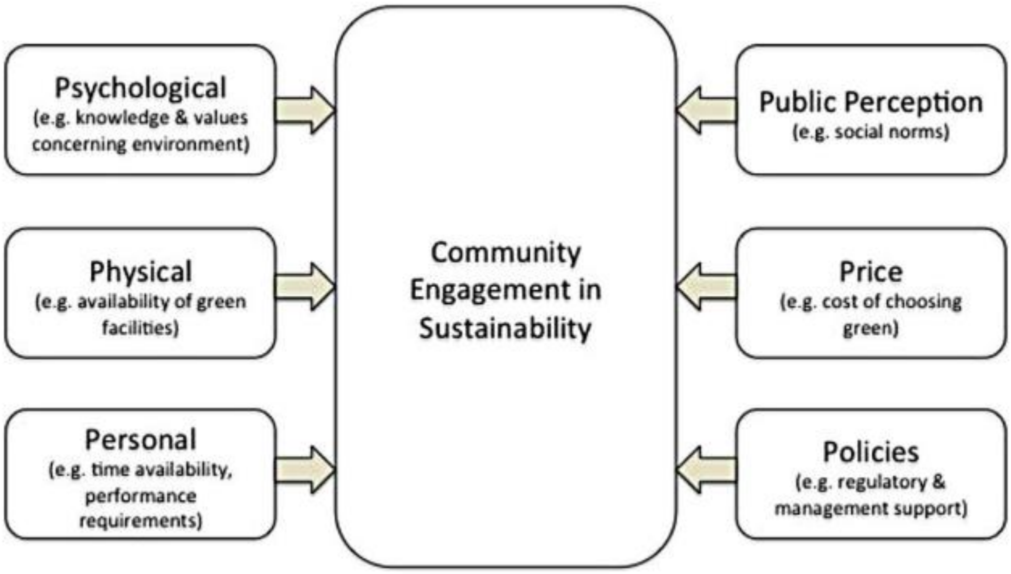


Figure 6.2*:* 6-P Framework highlighting the necessary components for community engagement in sustainability efforts (Too and Bajracharya, 2015)

Recommendations

To enhance FUS's culture of sustainability, we recommend the implementation of a Living and Learning Community (LLC) that is dedicated to sustainable lifestyles. FUS already fosters two LLCs that aim to create spaces accommodating specific student needs – the Swiss Culture Residence and the Health and Wellness Community. Creating a sustainability-oriented LLC promotes sustainability by educating individuals about the impact of their daily actions. The scope of these actions can include sustainable food consumption and disposal, as well as energy saving habits. Given the trend of using sustainable practices as marketing tools in institutions of higher education, the LLC would also serve to market FUS's awareness of climate change and the university's efforts to mitigate this global issue through education (Mcintosh et al., 2008; Stafford, 2011, as cited in Hale and Vogelaar, 2015).

Furthermore, we recommend that the Center for Sustainability Initiatives becomes FUS's Green Office (GO). Maastricht University established the first GO in 2010 (Green Office Maastricht, 2019). Since then, several universities across Europe have established their own GOs and many are working to develop their own. Universities can adapt GOs to best fit their needs; however, they typically include student and staff engagement, student volunteers, university funding, an office and an online presence, and an official mandate from university management. The purpose of the GO is to make sustainability more accessible and to integrate innovative initiatives into all areas of university functions, including education, research, operations, the community, and the university's governing bodies. By expanding into a Green Office, CSI and FUS would show support for the rest of the European community that is already involved in the GO initiative. While CSI is already a great indication of sustainability efforts on campus, it can recruit more volunteer engagement from students and staff, and lobby for further institutional support. As an organization actively working to achieve a whole-of-university approach, CSI is an essential aspect of Franklin's community engagement efforts in relation to sustainability; it would benefit greatly from integrating into the European community of Green Offices.

8. Tracking Progress

Continuing Action

The data recorded in FUS's Climate Action Plan are the baseline for future actions to be considered alongside to estimate progress made over time. With the first steps of FUS's Climate Action Plan completed, there is a need to ensure that data can be continually reported, tracked, and assessed in order to maintain a commitment to sustainable action. This task requires the cooperation of several departments, and it calls for a sustained commitment to the goals outlined in the plan. The first step towards a long-term commitment to sustainability is the responsibility of staff to report certain activities, and it is the intention of this report to make it a doable task.

Enactment and Supervision

FUS does not currently have a specific individual, department, or task force assigned to overseeing the progress of the university's sustainable practices. However, there is an evident need for such in order to ensure a continuing commitment to climate action. Therefore, we recommend that the students of the Environmental Studies capstone class in the following years assume the responsibility of tracking and analyzing the progress of the university's commitment to sustainable action. We also recommend that faculty consider introducing an interdisciplinary capstone class to take responsibility for the tracking of these data. An alternative or addition to this approach includes creating a student-led "Green Office" or a specific task force comprised of staff and/or faculty to collect and enter the data received. FUS may also consider eventually employing a sustainability officer as a member of the staff. The importance of creating a "Green Office" or related task force which is devoted to the continuation of the goals and strategies outlined in the Climate Action Plan cannot be understated. The institutional data which must be regularly collected in order to maintain FUS's commitment to climate action includes demographic information, details on the physical size of the campus, and certain budget allocation information (Second Nature, 2018). These data can be re-entered into the SIMAP emissions calculator and compared with data from past years to track FUS's progress.

Methods

At the end of each year, the departments which can provide relevant demographic, dimensional, and financial information will receive a spreadsheet to enter the required data. The departments will gather the necessary data and upload the spreadsheets onto FUS servers to be accessed by the capstone class or "Green Office" tasked with the collection and analysis of these data. The purpose of this is to ensure that the reporting of data from these departments is as simple and practical as possible. The departments should be encouraged to a straightforward routine to secure the persistence of the Climate Action Plan. FUS will ideally implement such a data collection strategy by the year 2020. Departments whose cooperation with the collection of future data is vitally important include the Office of Finance and Administration, the Office of the Registrar, the Office of Admissions, the Office of Student Life, and Dining Services. However, the cooperation of nearly every department on campus will be important in this ongoing process of data collection.

The Environmental Studies capstone class or "Green Office" will gather and review the collected data every four years, and they will enter the relevant data into the SIMAP emissions calculator. SIMAP is a tool which can easily be used and updated as time passes and will allow for simple evaluation year-by-year of the progress and endeavors of FUS in achieving its climate action goals. Every four years after gathering these data, the capstone class or "Green Office" will perform any necessary actions to evaluate the progress that FUS has made.

Beyond Measurement

Many of the goals and commitments that the implementation of the Climate Action Plan encourages are not tangible or quantifiable (Second Nature, 2018). Education, community outreach, and individual action cannot be entered into SIMAP's emissions calculator, but the impacts of these actions are of vital importance. Therefore, it is crucial to note that FUS's progress tracking methods will act as an indication of FUS's commitment to climate action as opposed to an absolute calculation of progress. We therefore propose that further evaluations include sections discussing the unquantifiable changes that FUS has made so that they can also track progress in the right direction. In addition, future supervision and implementation of the Climate Action Plan require a "whole-of-university approach" similar to that outlined by Mcmillin and Dyball (2009). This approach aims to create unity across the curriculum, campus operations, and research surrounding sustainability initiatives and activities within an institution, and thus requires that the staff, faculty, and students be made aware of and involved in the Climate Action Plan and its overall progression (Mcmillin and Dyball, 2009). Transparency and cooperation regarding sustainability on campus has been shown to increase the likelihood of an institution's ongoing and effective commitment to climate action and sustainable practices (Mcmillin and Dyball, 2009). Therefore, we suggest that these departments share their progress and any additional sustainability and climate-related information that they are willing to discuss with other staff, faculty, and students.

9. Conclusion

"The University is committed to promoting sustainability through research, education, outreach and international collaboration... We recognize that sustainability transcends geographic, political, cultural and disciplinary boundaries." (FUS, 2019c).

Franklin University Switzerland has continually acknowledged the importance of sustainability in its various curriculum and campus operations. It is necessary, however, for FUS to adopt a "whole-of-university" approach (Mcmillin & Dyball, 2009) so that sustainability-related curriculum, research, and campus operations may become more cohesive. This would help significantly in ensuring that FUS attains our climate action goals.

In addition, after collecting and evaluating accessible data to create the Climate Action Plan, we recognize that further research is necessary. The three climate mitigation strategies we have outlined in this document intentionally target only the emissions associated with activities directly financed by FUS. As we addressed in our baseline emission survey, this still leaves a large portion of recorded emissions unaddressed, including from student travel to and from FUS each semester and family travel for graduation. However, through the implementation of these strategies and our additional recommended actions, we believe that a ripple effect can be incited at FUS beyond institutional boundaries and into the community.

Through tangible actions, such as creating an offset fund and reaching out to alumni, we can increase our capacity to mitigate climate change. Through indirect actions, such as educating our community about reducing our environmental impact, we can change the conversation surrounding resource use, and pave the way for future change. In addition, the Climate Action Plan relies on the future cooperation of several individuals and departments at FUS to ensure that our goals are met. Therefore, the strategies outlined in the Tracking Progress section of the Climate Action Plan must be acknowledged and implemented by all members of the university.

Given the current social and political climate, a university's commitment to sustainability and climate action is unprecedented in its importance. Many prospective FUS students have expressed deep interest in environmental issues, and the same students have expressed specific interest in the Environmental Studies capstone class's efforts to create this Climate Action Plan. Therefore, current and future commitments to climate action will create a positive reputation for FUS as an environmentally-aware university among current and prospective students.

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Appendices

Appendix A: Detailed Methodology, Assumptions, and Missing Data for Each Scope

Scope 1	Solar Panel	• Data from the solar panels was gathered from AIL. • The solar panels were newly installed so only the data from December was put into the calculator
	Oil combustion	• Data for oil combustion was gathered from utility bills and entered into SIMAP tool • The billing cycles varied for many of the buildings so all data was split into two fiscal years
Scope 2	Utilities	• Data for electrical consumption was taken from the utility bills • For New A/B there was no current data for December there for an average of past years was used. It should be noted that December electricity of 2017 was higher than other past years. • For alba, the amount of electricity that is consumed was only considered for the portion of the building that FUS owns. • For the dorms Cilliegi and Giradino the amount of electricity consumed was approximated based on what dorm is most similar to them (LDV). This was done by determining the average electrical consumption that is consumed by students in LDV. • With the average approximated the number of students in each dorm was calculated for each fiscal term. This included all times the dorm has residents not just students using the facilities • Once calculated, all data was put into the SIMAP calculator • In the case of extra data, an average was taken to calculate the average value of a day. extra days value was estimated and then subtracted. • Due to the fiscal year some days in the summer sessions were subtracted from fiscal year one and then added to another.
	Missing from the 2019 inventory	• Water use data • Heating data
Scope 3	Academic Travel	• Data pertaining to mode of transportation and locations were gathered from all academic travel courses syllabi from Fall 2018 and Spring 2018.

		• We used Google Maps to estimate the distances from point a to point for all written activities using bus, train or car • We used Great Circle Mapper to estimate the kilometers traveled by plane • Kilometers for all activities and travels were noted; separated by mode: train, air, or bus travel • Raw data was plugged into SIMAP to gather the carbon footprint of academic travel
	Conferences	• Professor Hale provided information as to location and duration of conferences • Distances were estimated using Google Maps and entered into the SIMAP tool
	Graduation	• Data pertaining to distance traveled (km) per family attending spring graduation ceremony • The total distance traveled by family members to Lugano and back from their country of origin was calculated using average household size per country of origin based on UN data, and the distance of a direct flight to and from the country of origin • Exact cities of origin were used when possible, otherwise capital cities were assumed as the city of origin
	Food	• Data pertaining to perishable food (kg) purchased for both campus dining halls in the fall semester of 2018 • An annual figure was calculated by determining the average weight of food consumed by individuals in the fall, and applying the average to summer and spring semesters with adjustments for fluctuating student-faculty ratios • Since they did not have their own label categories in the template, turkey was labeled as pork and lamb was labeled as beef to keep the carbon footprint of each meat as accurate as possible
	Student commutes	• The Office of the Registrar provided lists of students' nationalities in terms of held passports for Spring and Fall 2018 semesters. Also provided were actual numbers of students attending FUS each semester. • Distance from the capital city of each nationality reported and Switzerland was calculated using Google Maps to estimate kilometers traveled at the beginning and end of each semester. • All students were assumed to make one round trip from FUS to their home country per semester attended.

		• Students who were known to hold multiple passports were asked where they primarily resided, and the additional nationalities were removed from the data. • Further discrepancy between number of nationalities and number of students was rectified by averaging the distance from Switzerland to each home country and applying it to the actual number of students. • Summer 2018 nationalities were not supplied, and therefore was estimated by multiplying the average commuting distance by students in Fall 2018 by the number of students attending Summer Sessions I and II.
	Faculty and staff commutes	• Data regarding the numbers of faculty and staff present on campus for each semester were obtained from the Office of the Registrar and the FUS faculty and staff directory. • Faculty and staff residences which were known were recorded, and distance to and from campus was calculated using Google Maps. Those which were not known were estimated to commute on average 14km to campus. • Faculty and staff whose number of trips per week were known were recorded. Other faculty were assumed to make one round trip three times per week. Other staff were assumed to make one round trip five times per week. • Primary transportation methods for faculty and staff which were known were recorded, and others were assumed to be split between personal vehicle transport (50%) or a carbon-neutral form of transport (50%), meaning via the Swiss train system, walking, biking, etc.
	Admissions counselors	• Data pertaining to dates and location of admissions trips of one US counselor and one international counselor received from the Admissions Office • Used Google Maps and online air mileage calculator WebFlyer to estimate kilometers traveled for each admissions event • Entered sum of kilometers by car, train, bus, and plane for US and international counselors separately into SIMAP tool in the Business Travel and Study Abroad section
	OSL Events	• Data pertaining to dates and locations of events and trips received from the Office of Student life • Used Google Maps to estimate distances traveled in kilometers from location to location

		• Entered sum of kilometers traveled for each trip individually and divided by mode of transportation in the Business Travel and Study Abroad into SIMAP tool for the appropriate mode of transportation – be it train, bus, or flight
	Missing from the 2019 inventory	• Non-perishable food data • Data regarding disposable cups, to-go containers • Detailed info regarding faculty and staff commuting by week and by semester • Emissions data from non-transit academic travel activities • Data regarding on-campus vehicle use by maintenance and IT staff • Detailed admissions travel data

Appendix B: Detailed data from baseline emissions inventory

Table B1: Measured eCO_2 emissions by source

Source	eCO_2 (metric tons)	% eCO_2
Student Travel to/from Home	1801.2	50.00
Family Travel for Graduation	960.16	26.65
Academic Travel	594.28	16.50
Natural Gas and Solar Energy	87.61	2.43
Faculty and Staff Commuting	79.65	2.21
Other Directly Financed Travel	67.27	1.87
Food	11.63	0.32
Purchased Electricity	0.95	0.03
Total	**3602.75**	**1**

Table B2: FUS directly financed baseline emissions by source

Source	eCO_2 (metric tons)	% eCO_2
Purchased Electricity	0.95	0.11
Food	11.63	1.38
Other Directly Financed Travel	67.27	7.99
Faculty and Staff Commuting	79.65	9.47
Natural Gas	87.61	10.41
Academic Travel	594.28	70.63
Total	**841.39**	**1**

Appendix C: Detailed Mitigation Strategies Methodology

Mitigation Strategy	Projection Calculations Methodology
Food Emissions	To calculate estimated emissions from food consumption on campus, we collected data for the total volume of perishable food by item. We then grouped the items by food type (vegetables, fruits, spices, potatoes, beans, milk, cheese, chicken, pork, and beef) and designated each as locally-sourced or non-locally sourced. We grouped all foods which did not have a separate category into closest type by emissions/kg as they appear in the SIMAP tool (e.g. lamb is included with beef, turkey is included with pork, and yogurt is included with cheese). Though the local/non-local designation did add an additional factor to emissions calculations, emissions from the transportation of food from the place of origin are not taken into account. Using these metrics, we calculated the eCO_2 values for each section in the SIMAP tool. To calculate mitigation pathways for food consumption on campus in the North Campus Dining Hall and the Grotto, we then separated the food types into four categories (beef, other meats, dairy, plant-based options) and calculated values for total volume of perishable food, as well as total emissions and emissions by food type. We used value proportions of food types as % of the total volume (other meats, dairy, and plant-based foods as a % of non-beef food; dairy and plant-based foods as a % of all vegetarian foods) as coefficients to calculate the proportion of each removed category to add to remaining sections (see proportionality table). To account for differences in caloric density, we calculated individual proportions (dairy: meat, plant-based: meat, and plant-based: dairy), assuming an equal caloric density for all meats (see nutritional adjustment table). We then removed food types in three sections (beef, all meat, all meat and dairy) corresponding with the three mitigation strategy levels (non-beef, non-meat, plant-based) and redistributed the removed food volume proportionally, adjusting volume to match caloric proportions. We then calculated eCO_2 values using the average emissions by food type. We then compared mitigation strategy levels (non-beef, non-meat, plant-based) with corresponding projected reduction guidelines (emissions reductions of 26%, 50%, and 100%, respectively).
Solar Energy	To calculate estimated energy use emissions mitigation, we used data from purchased electricity, natural gas use, and estimated yearly emissions offsets from solar panels. For the first mitigation strategy level, we subtracted estimated offsets from current solar panels in place from the total energy emissions, with the second and third strategy levels accounting for estimated offsets from proposed solar panels 1-4 and 1-8, respectively, grouped for greatest impact with initial action but these may be applied in any order or grouping.
Financed Travel	To calculate projected emissions reductions pathways for academic travel programs, we selected six academic travels, three from the Spring semester, and three from the Fall semester. (POL 377T, ECN 331T, TVL 298, TVL 358,

	AHT 218T, and TVL 248). We chose these six travels[3], together they accounted for 72% of emissions from all 27 academic travels, 95% of which resulted from air travel. • For the first mitigation strategy level, we considered flight paths. For these travels, direct flights could be found from either Milan (MXP) or Zurich (ZRH) to their final destination. We then calculated emissions reductions resulting from adjusted flight paths using emissions coefficients for air travel. • For the second mitigation strategy level, we subtracted remaining offsets from solar panels (after accounting for emissions from purchased energy and natural gas) from the total academic travel emissions, minus reductions from the first level. • For the third mitigation strategy level, we accounted for all remaining academic travel emissions through purchased third-party offsets, using the average cost of a purchased offset/kg at CHF 3(calculated from a cost range of CHF 0.5- CHF 50 per tCO_2) We compared the estimated cost to offset remaining emissions after primary offsets are applied (strategy 3, levels 1-2) to the estimated total cost to offset all academic travel emissions without primary offsets, shown in Figure X. • To calculate projected offsets of all directly financed travel, we applied the average cost of purchased offsets at 3chf/kg eCO_2 to estimate the cost of offset for all three levels of mitigation (26%, 50%, and 100%). We then compared this estimated cost to the estimated cost of offsetting travel emissions without applying FUS-based travel offsets included in mitigation strategy 3. For mitigation strategies, as defined in the baseline emissions inventory, we excluded emissions data from students traveling to/from FUS, and family travel for graduation, as they are not directly financed by FUS.

[3] CLCS 251T and ENV 280T, two travel courses which took place in the summer session, also accounted for a large portion of the travel emissions, however they were excluded from this mitigation group as they took place over a larger time period, around four weeks, and therefore their emissions per day were comparatively lower than the other high-emitting travels which took place over an average of ten days

Appendix D: Detailed data and calculations for food purchase and consumption

Table D1: Detailed calculation of food purchasing sources

Country	Food Quantity (kg)	Percent Total Food
Italy	1222.75	30.59
Switzerland	2025.75	50.68
Spain	90.5	2.26
Middle East	42	1.05
China	83	2.08
Netherlands	67.5	1.69
Caribbean	188	4.70
Hungary	94	2.35
Uruguay	29.5	0.74
Argentina	29.5	0.74
New Zealand	29	0.73
Norway	48	1.20
Sweden	24	0.60
Denmark	24	0.60
	3997.5	

Table D2: Detailed calculation of emissions by food type

Type of Food	Weight (kg)	Weight (Percent)	eCO_2 (kg)	eCO_2 (Percent)	eCO_2 per kg
Beef	219	6.55	5718	49.16	26.11
Cheese	228	6.82	2166	18.62	9.5
Pork	145	4.34	966	8.31	6.66
Chicken	157	4.70	791	6.80	5.04
Fish	116	3.47	444	3.82	3.83
Milk	213	6.37	277	2.38	1.30
Beans	82	2.45	62	0.53	0.76
Vegetables	1209	36.18	860	7.39	0.71
Spices	98	2.93	69	0.59	0.70
Fruits	677	20.26	238	2.05	0.35
Potatoes	198	5.92	40	0.34	0.20
Totals	**3342**	**1**	**11631**	**1**	

Table D3: Average emissions by food type (general categories)

Food Type	Average eCO_2 per kg
Beef	26.11
Non-Beef Meats	5.18
Dairy	5.40
Plant-Based	0.55

Table D4: Food type proportions

Type of Food	Weight (kg)	Weight by percentage
Non-Beef Meat	418	0.13
Dairy	441	0.14
Plant-Based	2264	0.72
Total (No Beef)	**3123**	
Dairy	441	0.16
Plant-Based	2264	0.84
Total (No Meat)	2705	

Table D5: Calculations for nutritional adjustments for food strategies

Source	Original weight (kg)	Proportion to	kg:kg
Beef	219	meat	1
Other Meat	418	meat	1
Dairy	441	meat	0.69
Plant-Based	2264	meat	3.55
Plant-Based		dairy	5.13

Table D6: Calculations for no beef food strategy

Removed	**kg**						
Beef	219						
Type of Food	**Weight**	**Weight %**	**kg +**	**kg:kg meat**	**kg total**	**avg eCO_2 /kg**	**eCO_2 (kg)**
Non-Beef Meat	418	0.13	29.31	1.00	447.31	5.18	2315.27
Dairy	441	0.14	30.93	0.69	471.93	5.40	2548.51
Plant-Based	2264	0.72	158.76	3.55	2422.76	0.55	1320.45
Totals	**3123**						**6184.22**
						eCO_2	6.18

Table D7: Calculations for 50% beef food strategy

Removed	**kg**						
Beef	219						
Type of Food	**Weight**	**Weight %**	**kg + (meat)**	**kg:kg meat**	**kg total**	**avg eCO_2 /kg**	**eCO_2 (kg)**
Beef	109.5	-	-	-	109.50	26.11	2859.00
Non-Beef Meat	418	0.13	14.66	1	432.66	5.18	2239.41
Dairy	441	0.14	15.46	0.69	451.70	5.40	2439.31
Plant-Based	2264	0.72	79.38	3.55	2546.13	0.55	1387.68
Totals	3123						8925.41
						eCO_2	8.93

Table D8: Calculations for meatless Mondays food strategy

Removed	**kg**						
Beef	31.29						
Non-Beef Meat	59.71						
Type of Food	**Weight**	**Weight %**	**kg + (meat)**	**kg:kg meat**	**kg total**	**avg eCO_2/kg**	**eCO_2 (kg)**
Beef	187.71	-	-	-	187.71	26.11	4901.14
Non-Beef Meat	358.29	-	-	-	358.29	5.18	1854.47
Dairy	441	0.14	12.85	0.69	449.90	5.40	2429.55
Plant-Based	2264	0.72	65.97	3.55	2498.47	0.55	1361.71
Totals	**3123**						**5645.72**
						eCO_2	5.65

Table D9: Calculations for no meat food strategy

Removed	kg
Beef	219
Non-Beef Meat	418

Type of Food	Weight	Weight %	kg + (meat)	kg:kg meat	kg total	avg eCO_2/kg	eCO_2 (kg)
Dairy	441	0.16	35.70	0.69	465.72	5.40	2514.99
Plant-Based	2264	0.84	183.30	3.55	2915.46	0.55	1588.98
Totals	**2705**		**219**				**4103.96**
						eCO_2	4.10

Table D10: Calculations for all plant-based food strategy

removed	kg
Beef	219
Non-Beef Meat	418
Dairy	441

Type of Food	Weight	kg + (meat)	kg:kg meat	kg + (dairy)	kg:kg dairy	kg total	avg eCO_2/kg	eCO_2 (kg)
Plant-Based	2264	219	3.55	441	5.13	5306.36	0.55	2892.05
							eCO_2	2.89

Appendix E: Energy Usage

Table E1: Explanation of the degrees of solar panel locations

Tilt (Degree)	SP Locations	Tilt & Location: Explanation
0	1	Axis tracking panels are set at default to 0
10	2, 3, 4, 5, 6, 8	Following current Solar Panel Project; New A and B solar panels are tilted at 10
20	7	Fixed (open mount) are set at default to 20

(SFOE, 2019)

Table E2: Explanation of array type of solar panel locations

Array Type	SP Locations	Array Type & Location: Explanation
Fixed (roof mount)	2, 3, 8	Roofs currently exist in these locations, so standard mounts function without structure adaptation.
Fixed (roof mount)	4, 5 and 6 (parking lots)	Overhead roof structure required. Once constructed, it allows for fixed mounting systems.
Fixed (open rack)	7	Ground mounts set at an angle that allow airflow to prevent overheating.
2-axis Tracking	1	Dual-axis tracking systems can also adjust based on seasonal variations in the sun's position; increase the production of solar panels by 25%

(NREL, 2019)

Table E3: Expected Cost of Solar Panels

Solar Panels	Size	Annual Fee	Annual Maintenance Fee	Total
Sp 1	273.4	CHF 44'571.86	CHF 838.51	CHF 45'410.36
Sp 2	44.8	CHF 7'303.65	CHF 137.40	CHF 7'441.05
Sp 3	60.6	CHF 9'879.50	CHF 185.86	CHF 10'065.35
Sp 4	25.2	CHF 4'108.31	CHF 77.29	CHF 4'185.59
Sp 5	40.5	CHF 6'602.63	CHF 124.21	CHF 6'726.85
Sp 6	20.9	CHF 3'407.29	CHF 64.10	CHF 3'471.38
Sp 7	8.9	CHF 1'450.95	CHF 27.30	CHF 1'478.25
Sp 8	44.1	CHF 7'189.53	CHF 135.25	CHF 7'324.79
			Total	CHF 86'103.63

*= Costs calculated based on current solar panels

(AIL)

Table E4: Satellite Images of 8 solar panel locations and suitability of locations. Red: excellent, orange: very high, yellow: high)

	Satellite Images of possible SP locations	Suitability
SP 1* Soccer Field		
SP 2 LDV		
SP 3 Panera		
SP 4* Panera Parking lot		
SP 5* Main Student Parking lot		
SP 6* Parking lot between North Villa & Lab Building		
SP 7* Green Space above North Campus parking lot (SP 6)		
SP 8 LAC		

*= Approximate suitability estimated by building next to it

(SFOE, 2019)

Table E5: Estimated yearly cost savings of solar panels*

Solar Panel	Expected Energy Retrieval (kWh/Year)	Solar Radiation (kWh/m²)	Expected Carbon Offset (metric tons)	Cost Savings (offset price of 15 CHF/metric ton)	Cost Savings (offset price of 96 CHF/metric ton)
SP 0	51,000	3.1	25.2	378	2419.2
SP 1	309,000	3.21	153	2295	7650
SP 2	49,800	3.1	25.1	376.5	1255
SP 3	68,900	3.1	33.9	508.5	1695
SP 4	28,600	3.1	14.04	210.6	702
SP 5	45,900	3.1	22.7	340.5	1135
SP 6	23,700	3.1	11.7	175.5	585
SP 7	10,100	3.21	5	75	250
SP 8	49,900	3.1	24.7	370.5	1235
TOTAL	636,900	-	**315.3**	4730.1	16926.2
SP 0	51,000	3.1	25.2	378	2419.2

* As solar panels represent an alternative to purchase of third-party offsets, savings are calculated as the yearly cost of purchased offsets bypassed by offset via solar panel, and are not a net savings, thereby excluding initial cost of solar panels

Appendix F: Travel

Table F1: Emissions of all 2018 travels, with the six travels selected for first-party direct flight mitigation highlighted

Course Codes	Academic Period	eCO_2 Total
BUS 105T	Spring 2018	0.46996255
COM 204T	Spring 2018	1.70771652
CRW 110T	Spring 2018	5.85175012
ECN 331T	Spring 2018	79.8086692
ENV 230T	Spring 2018	1.22556593
LIT 221T	Spring 2018	9.75180751
POL 101T	Spring 2018	13.5651028
STA 275T	Spring 2018	0.47854599
TVL 298T	Spring 2018	150.643731
TVL 248	Spring 2018	15.3610343
AHT 257T	Summer 1 2018	2.17820002
CLCS 251 T	Summer 1 2018	33.4219467
ENV 280T	Summer 1 2018	56.4783052
AHT 218T	Fall 2018	21.995489
BIO 210T	Fall 2018	0.46722419
BUS 115T	Fall 2018	0.13912399
CLCS 238T	Fall 2018	9.09815711
CLCS 248T	Fall 2018	0.28096386
CLCS 253T	Fall 2018	15.0688811
COM 230T	Fall 2018	0.48450164
HIS 215T	Fall 2018	0.69379151
ITA 100T	Fall 2018	0.57270389
MAT 115T	Fall 2018	0.38543866
POL 223T	Fall 2018	9.25901326
POL 377T	Fall 2018	120.783264
TVL 358T	Fall 2018	38.0854011
VCA 120T	Fall 2018	6.49309878
Total		594.74939

Figure F1: Academic Travel 2018 transport by KM

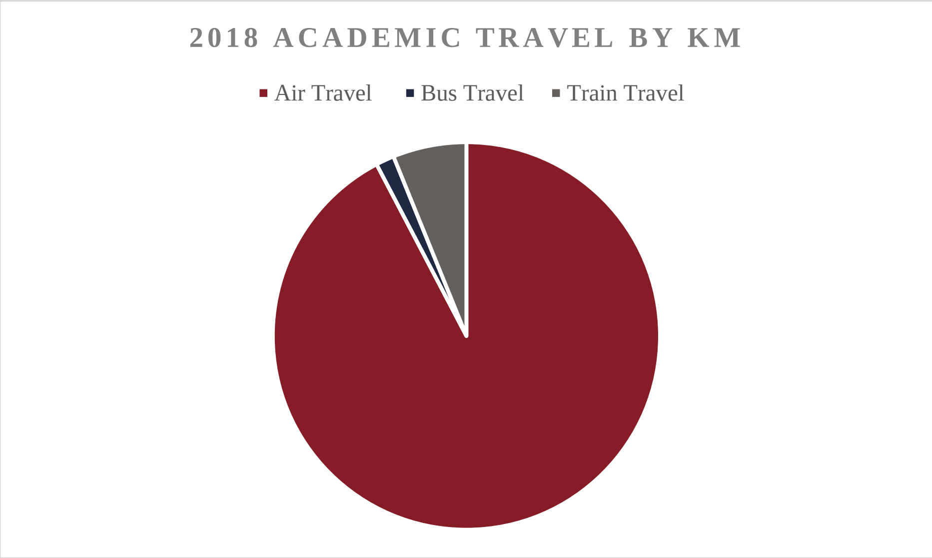

Figure F2: Academic Travel 2018 by emissions

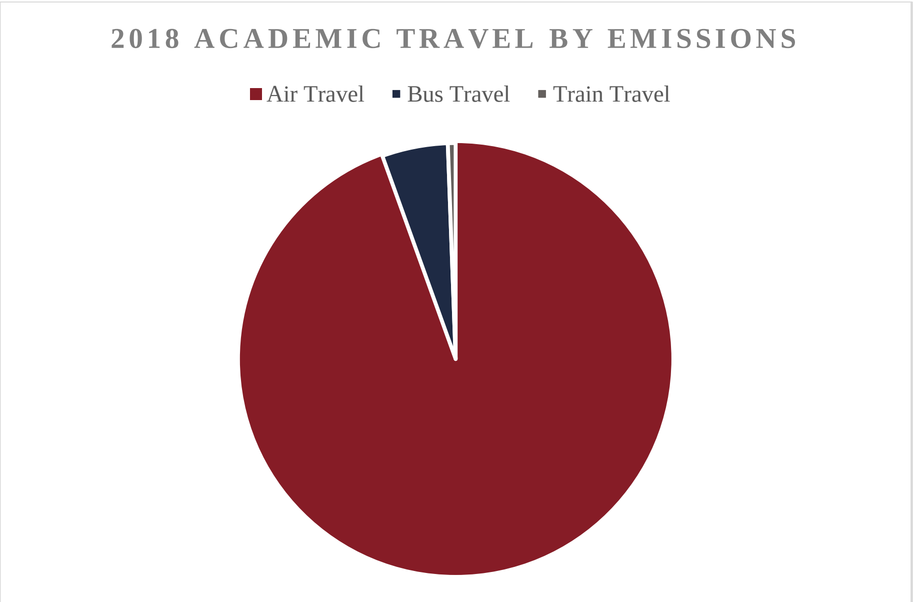

Table F2: Calculations for academic travel mitigation strategy direct flights

Location	Course Codes	Academic Period	Students	eCO_2 Total	KM Flights	eCO_2 Flights	eCO_2 Total	KM Direct Flights	Direct Flight eCO2
Johannesburg/ Botswana/Zi-mbabwe	POL 377T	Fall 2018	24	120.78	555150	107.27	120.78	16774	77.79
Rishekesh/ Bhutan	ECN 331T	Spring 2018	24	79.81	411700	79.55	79.81	12339	57.22
South Africa/Swazil-and	TVL 298T	Spring 2018	24	150.64	776100	149.96	150.64	18740	86.91
Tbilisi/Baku	TVL 358T	Fall 2018	24	38.09	175050	33.82	38.09	6883	31.92
Porto/Lisbon/ Belem	AHT 218T	Fall 2018	24	22.00	108875	21.04	22.00	3259	15.11
Andalusia	TVL 248	Spring 2018	24	15.36	75500	14.59	15.36	2209	10.24
Total				426.68	2102375	406.24	426.68	60204	279.19

Figure F3: Estimated costs of third-party offsets for all directly-financed travel at each mitigation level, with and without first-party offsets, at a cost of 15 CHF/metric ton of CO_2

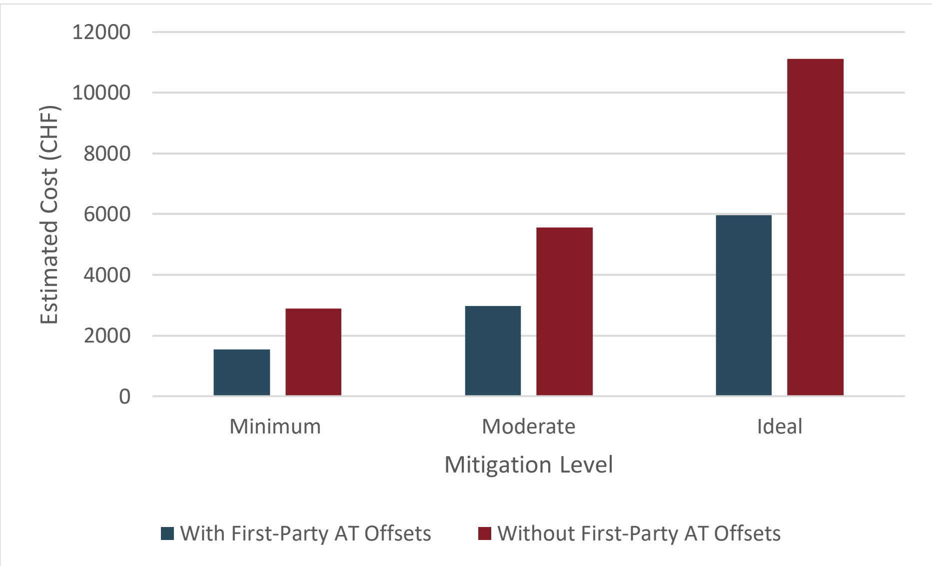

Table F3: Calculated estimated costs of third-party offsets for all directly-financed travel at each mitigation level, with and without first-party offsets, at a cost of 15 CHF/metric ton of CO_2

	Minimum	Moderate	Ideal
With First-Party AT Offsets	1550.02	2980.82	5961.63
Without First-Party AT Offsets	2890.68	5559.00	11118.00

Figure F4: Estimated costs of third-party offsets for all directly-financed travel at each mitigation level, with and without first-party offsets, at a cost of 96 CHF/metric ton of CO_2

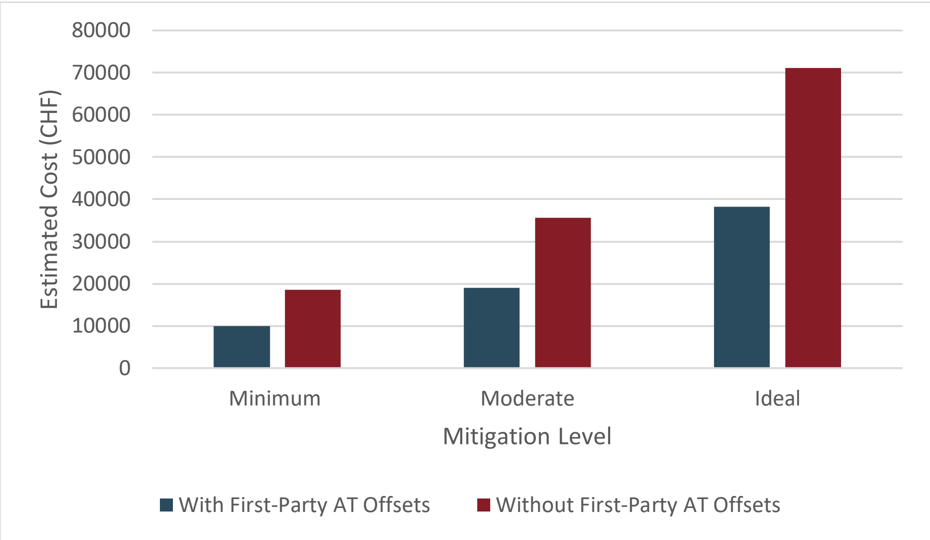

Table F4: Calculated estimated costs of third-party offsets for all directly-financed travel at each mitigation level, with and without first-party offsets, at a cost of 96 CHF/metric ton of CO_2

	Minimum	Moderate	Ideal
With First-Party AT Offsets	9920.16	19077.23	38154.46
Without First-Party AT Offsets	18500.35	35577.60	71155.20

Appendix G: Determining the extent of interdisciplinary courses at FUS that express a clear connection to environmental, economic, or socio-cultural sustainability.

Methodology: To determine the number of sustainability-related courses offered at Franklin University Switzerland; our team used a keyword search of the online Academic Catalog 2018-2020 to compile an initial list. The keywords used were: “sustainable”, “sustainability”, and “climate change.” We augmented the resulting list of courses by including any courses considered part of the sustainability tracks outlined in the SJS minor (environmental; political and economic; cultural) (FUS, 2018). During the process of obtaining course titles from the Academic Catalog, we reviewed the course descriptions of each course and further added courses that talked about sustainability-related topics, such as migration, ecology, ecosystems, inequality, and justice. This is likely not an exhaustive list of the university’s sustainability-related courses by nature of the qualitative approach used in its compilation; some excluded courses at FUS include independent research projects or internship requirements that are student-directed and may pursue sustainability topics on a case by case basis. First-Year Seminar (FYS) courses do not appear in the 2018-2020 Academic Catalog and thus, we only included FYS courses based on course title alone, as they appeared in the 2018 Course Schedule.

Course Code	Course Title	Course Code	Course Title
AHT 211	Collecting and the Art Market in the Age of Globalization	ENV 210*	Natural Disasters, Catastrophes, and the Environment
AHT 257T*	Introduction to the History of Architecture	ENV 220*	Ecocritical Approaches to Literature
AHT 361W*	The Visual Culture of Disaster	ENV 280T*	Managing the New Zealand Environment
AHT 375	Nature City Post-1960	ENV 281T	Managing Ecosystems in the American Rockies
BIO 101	Introduction to Biology: Genetics, Evolution, and Ecology	ENV 282T*	Tourism and the Environment: Iceland
BIO 102	Introduction to Biology: Cell and Animal Biology	ENV 350	Swiss Environments
BIO 103	Introduction to Biology: Plant Science	ENV 360	Research Methods in Environmental Sciences
BIO 210T*	Alpine Ecosystems	ENV 372W*	Sustainability Science
BIO 301W	Conservation Biology	ENV 497	Senior Capstone
BUS 381	Sustainability and Innovation Management	FRE 324	From Beur to Post-Beur Literature: Exile, Margins, and Re-Territorialization
CLCS 241W	Forbidden Acts: Queer Studies and Performance	GEO 101	Introduction to Physical Geography

CLCS 242	Representations of Poverty in Literature, Film and the Media	GEO 125T*	Venice as a Geographic Topos for Discovery
CLCS 245	Critical Approaches to the Graphic Novel: Justice in the Gutter	HIS 202(T)	History of Switzerland
CLCS 248T	European Food Systems: You Are Where You Eat	HIS 325	Human Rights in History
CLCS 250*	Ecocritical Approaches to Film	LIT 243	On Being Human
CLCS 253T	On Refugees: Representations, Politics and Realities of Forced Migration: Greece	LIT 370	Literature and the Land: Aotearoa-New Zealand
CLCS 260T	Berlin: Migration and Transformation of the Urban Landscape	POL 225T*	Politics and Society in Mesoamerica
CLCS 320	Culture, Class, Cuisine: Questions of Taste	POL 281(T)*	Sustainable Development in Africa: Politics, Prospects, and Practice
CLCS 330W	The Politics of Mobility: Exile and Immigration	POL 302W	Political Philosophy
CLCS 350W	Culture and Human Rights	POL 376(T)*	International Environmental Politics
CLCS 360	Critical Race Studies in a Global Context	POL 377(T)*	International Political Economy
CLCS 371W	Law and Culture	POL 378	International Politics of Energy
CLCS 372W	Tales of Catastrophe	POL 398	Human Rights in International Law and Politics
COM 204*	Media Ecology	PSY 315	Environmental Psychology
COM 301	Globalization and Media	SJS 100*	Sustainability and Social Justice: Ethics, Equality, and Environments
COM 352	Environmental Discourses	SJS 199	Ethics and the Environment
ECN 303	Development Economics	SJS 498	Internship
ECN 330T	Neo-liberal India: Globalization and Development	SJS 499	Senior Research Project
ECN 331T*	Sustainable Economic Development: Exploring Bhutan and Kaziranga	STA 230*	The Fashion of Form: Concept to Construction
ECN 341	International Trade	STA 235*	Sustainability and the Studio
ECN 355W	Political Economy: Theories and Issues	STA 240T*	Sustainability and Art in Europe

ENV 199	First Year Seminar Various Titles	STA 331T*	Umbria: Sustaining Art in the Heart of Italy
ENV 101*	Chemistry and the Environment	WTG 200	Advanced Academic Writing: Ethics at Work
ENV 200	Understanding Environmental Issues		

*Courses that include the words "sustainable," "sustainability," or "climate change" in their title or description.
T: Courses that include an Academic Travel component.
(T): Courses that are offered both with and without an Academic Travel component.
W: Courses that are writing intensive.