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Counting carbon: Reducing the Climate Impact of the Wyss Academy's Operational Emission Sources

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handed in by

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ABSTRACT

The Wyss Academy for Nature operates globally through four regional hubs to develop solutions that transform the relationship between people and nature. While sustainability is at the core of the Wyss Academy's mission, its activities generate greenhouse gas emissions, particularly from travel. To align with the goals of the Paris Agreement, it is essential to assess emissions, identify reduction potential, and address residual emissions. This thesis compiles the Wyss Academy's greenhouse gas inventory and suggests options for aligning operations with climate targets. The research addresses two key questions: (1) What is the Wyss Academy's greenhouse gas footprint and how large is the contribution of flight emissions to the overall footprint? (2) What strategy could the Wyss Academy adopt to align with the Paris Agreement targets, including reducing flight emissions without compromising its mission and addressing the climate impacts of residual emissions in the most environmentally responsible way?

The study applies the GHG Protocol to quantify emissions across operational activities and evaluates reduction options using alternative mitigation scenarios. Results reveal that flight emissions constitute the overwhelming majority of the Wyss Academy's greenhouse gas footprint. Recommendations include limiting flights to essential travel, substituting short-haul flights with rail, reducing flights from external stakeholders, reducing flights on highly popular routes, and implementing a carbon budget for air travel. To address residual emissions, a climate contribution approach is proposed that incorporates an internal carbon fee and diverse climate positive investments.

This thesis provides actionable suggestions for reducing the climate impact of the Wyss Academy's operational emission sources, while maintaining mission effectiveness. By adopting these strategies, the Wyss Academy can enhance its sustainability-oriented mission through the integration of sustainable operational practices.

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ABBREVIATIONS

API	Application Programming Interface
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
ERI	Exponential Roadmap Initiative
EWB	Energie Wasser Bern
FTE	Full-Time Equivalent
g	Gram
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHGMI	Greenhouse Gas Management Institute
GoO	Guarantees of Origin
GWP	Global Warming Potential
HKN	Herkunftsnachweise
kg	Kilogram
km	Kilometer
kWh	Kilowatt hour
MSW	Municipal Solid Waste
MWh	Megawatt hour
N_2O	Nitrous Oxide
NGO	Non-Governmental Organization
OJP	Open Journey Planner
pkm	Passenger-kilometer
R&D	Research and Development
SBB	Swiss Federal Railways (*Schweizerische Bundesbahnen*)
SBTi	Science-Based Targets Initiative
SEI	Stockholm Environment Institute
SNID	Switzerland’s National Inventory Document
t	Metric ton
UID	Unique Identifier
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

1 INTRODUCTION

In recent years, net zero emission pledges have become the mainstream approach for governments and companies to showcase their support for climate change mitigation. The net zero approach aligns with the wider scientific assessment that reaching greenhouse gas (GHG) neutrality globally is crucial to stabilize global mean temperature levels (IPCC, 2013). Furthermore, in order to limit global warming to 1.5°C above pre-industrial levels with no or limited temperature overshoot, GHG neutrality should be achieved by 2050 (Rogelj et al., 2018). This temperature target would considerably reduce the risks to human, animal and plant life compared to the less ambitious goal in the Paris Agreement of 2°C global warming (Hoegh-Guldberg et al., 2018) which would require reaching net zero by the early 2070s (IPCC, 2021).

As a result, many countries and non-state actors have already committed to reach carbon or GHG neutrality by mid-century. While this process started slowly at first, net zero pledges have proliferated in recent years. At the country level, a recent report by Net Zero Tracker underlines that national net zero targets cover 91% of global gross domestic product (GDP) as of June 2022 (Hans et al., 2022). This is up from only 19% in June 2019 (ECIU, 2019) and 68% in March 2021 (Black et al., 2021). It should be mentioned that these figures include all types of pledges even if no plans to achieve them have been elaborated yet. As a result, action from non-state actors including subnational governments and companies is urgently needed to accelerate this transition. Different initiatives act as catalyzers for private sector climate ambition. For example, the Race to Zero campaign backed by the United Nations brings together over 11’000 non-state actors dedicated to halving emissions every decade and achieving net zero by 2050, i.e. in line with the 1.5 degree goal (UNFCCC, 2023).

However, this seemingly high level of commitment by state and non-state actors also hides a more worrying reality. In a recent study by Hale et al. (2022), net zero targets of 4’000 entities spanning countries, companies and subnational governments were analyzed. The findings of this review revealed that a substantial proportion of net zero pledges exhibited a lack of robustness in terms of coverage, timing and governance across all types of entities. In the worst cases, companies may use net zero commitments as a form of greenwashing (Montgomery et al., 2023). In fact, Net Zero Tracker (Hans et al., 2022) found that only 3% of the Forbes Global 2000 companies that have set a net zero target fulfill the Race to Zero‘s starting line’ criteria when committing to net zero. They are commonly called the ‘4P’ criteria (Hans et al., 2022):

1. A specific net zero **Pledge.**
2. A published **Plan** on how organizations intend to achieve its short- and long-term target.
3. Immediate action to **Proceed** on their commitments.
4. **Publishing** progress reports.

Even net zero pledges that are currently lacking quality and concreteness may nevertheless lead to long-term benefits. They create expectations among stakeholders and society as a whole and also provide a basis for third parties to keep companies accountable for their promises (Hans et al., 2022). Rising scrutiny by third parties has led to the elaboration of harmonized and evidence-based standards and an emphasis on transparency. Arguably, the most prominent standard was established by the Science-Based Targets Initiative (SBTi). It focuses on guiding companies to implement decarbonization plans that align with the 1.5°C target of the Paris Agreement (SBTi et al., 2024).

Net zero standards such as SBTi, however, target primarily companies and governments and exclude non-governmental organizations (NGOs), which includes nonprofits and foundations. Despite their instrumental role in the elaboration of net zero standards (e.g., SBTi) and in driving companies to adopt sustainable practices, NGOs are left without explicit net zero standards for themselves.

Despite this gap, a study by Koster et al. (2019) revealed that NGOs with a specific sustainability-related mission are driven to behave in line with their principles in their internal operations, not only because it reflects their values but also to safeguard their credibility and legitimacy. However, the study also showed that a sustainability-related mission may grant NGOs a level of immunity from external scrutiny, potentially leading them to shift resources away from improving internal operations in favor of their main areas of work.

Recently, the carbon footprint of NGOs has been increasingly scrutinized by the media. Concerns range from the environmental impact of frequent international flights (Dayyeh, 2023) to the surprising scarcity of emissions data (Salzenstein & Pedersen, 2021). These criticisms pose a threat to the reputation and influence of NGOs, as they are expected to "walk-their-talk" (Koster et al., 2019). Therefore, NGOs should urgently address these criticisms by disclosing their emissions data, implementing measures to reduce their emissions and setting credible net zero targets.

However, the lack of specific guidance or net zero standards available to NGOs may hamper their efforts to reduce GHG emissions and meet the targets of the Paris Agreement. To address this gap, we undertake a case study of Wyss Academy for Nature at the University of Bern (hereinafter Wyss Academy). Our aim is to develop a greenhouse gas inventory and a net zero strategy for the Wyss Academy that can be adaptable to other small to medium-sized NGOs.

Given that the Wyss Academy operates on four continents, we hypothesize that international business flights represent the bulk of the Wyss Academy's GHG emissions. With this in mind, we focus on the following research questions:

1. What is the GHG footprint of the Wyss Academy and how large is the contribution of flight emissions to the overall footprint?
2. What strategy could the Wyss Academy adopt to align with the Paris Agreement targets? This includes the following sub-questions:
   a. How can flight emissions be reduced without compromising the Wyss Academy's mission?
   b. What are the most environmentally responsible options for the Wyss Academy to address the climate impacts of residual emissions?

2 METHODS

2.1 CONTEXT

The Wyss Academy for Nature is a foundation and non-profit organization embedded within the University of Bern. It was founded in 2020 and focuses on addressing a broad range of environmental issues such as climate change, biodiversity loss and land-use challenges. Building on scientific knowledge and innovation, the Wyss Academy's mission is to develop solutions that transform the relationship between people and nature.

To this end, the Wyss Academy operates in four regional hubs located in East Africa, South America, Southeast Asia and Switzerland. The Wyss Academy uses an innovative approach to overcome the gap between knowledge and concrete actions. With the four regional hubs it aims to embed solutions to global challenges in local contexts.

2.2 SCIENTIFIC RATIONALE FOR NET ZERO TARGETS

In the context of this thesis, it is important to establish a common understanding of *net zero targets* and related concepts. First, the use of different terms related to *net zero emissions* may lead to confusion. Following the attempt by Rogelj et al. (2015) to provide conceptual clarity, we use the term *net zero emissions* when referring to all GHG emissions of anthropogenic origin. We refrain from using the term *climate neutrality*, which has been used as a synonym in the past, as it could also be defined in a broader sense by, for example, including human influences on the Earth's surface albedo.

A *net zero target* refers to the objective of achieving net zero emissions at some determined time in the future. The establishment of net zero targets can be undertaken at various governance levels, including the global, national, organizational and project levels. The targets should cover all anthropogenic GHG emissions covered within the set reporting boundaries. As the term *net* suggests, emissions do not need to be reduced to zero, but all remaining emissions caused by the target-setter must be compensated with removals of the same amount (International Organization for Standardization, 2022).

The scientific reasoning behind net zero targets can largely be attributed to the discovery of the nearly linear relationship between global-mean warming and cumulative CO_2 emissions since the industrial revolution (Allen et al., 2009). The main implications of this correlation are threefold. Firstly, it is possible to express average global temperature increases as an amount of cumulative CO_2 emitted to the atmosphere (IPCC, 2013). Secondly, the distribution of CO_2 emissions over time does not influence the level of warming, as long as the cumulative CO_2 emissions do not exceed the associated threshold (Matthews et al., 2009; Zickfeld et al., 2009). Thirdly, temperature stabilization requires limiting cumulative CO_2 emissions, which is only feasible by reducing net anthropogenic CO_2 emissions to zero (Matthews & Caldeira, 2008).

This characteristic of the Earth System enables a fairly straightforward estimation of the remaining budget of CO_2 humans can emit until global warming reaches a given level. This "carbon budget" can be allocated freely across a defined time horizon. Nonetheless, net anthropogenic CO_2 emissions need to cease when the carbon budget is exhausted for temperature stabilization to be achieved.

Hence, a global net zero CO_2 target refers to the goal of achieving this end-state, where cumulative CO_2 emissions stop increasing and mean temperature levels can start stabilizing. The scientific foundation for net zero emissions applies strictly to CO_2 and not to non-CO_2 gases due to their limited lifetime in the atmosphere (Rogelj et al., 2015). In contrast, CO_2 emissions influence the whole Earth System as the carbon cycles through the atmosphere, biosphere and oceans which increases atmospheric CO_2 concentrations for millennia (Joos et al., 2012). This being said, other GHG emissions are usually also included in net zero targets (e.g., Paris Agreement) and in net zero guidelines (e.g., Falk, 2023; SBTi et al., 2024; International Organization for Standardization, 2022). Metrics, such as Global Warming Potential (GWP) over 100 years, are used to translate the climate impacts of different GHG to a common unit, namely CO_2 equivalent (CO_2e).

With the Paris Agreement, countries agreed to the global objective of limiting global warming to well below 2°C, preferably 1.5°C, above pre-industrial levels and achieving "a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (Paris Agreement, 2015, Articles 2 & 4.1). Hence, the Paris Agreement sets a relatively precise global net zero target that includes (1) a target date, (2) a limit on temperature rise, hence, a limit on cumulative CO_2e emissions, and (3) a coverage inclusive of non-CO_2 GHGs. The Paris Agreement's objectives now serve as guiding threads for private and public institutions to set science-based net zero targets.

2.3 GREENHOUSE GAS INVENTORY

2.3.1 Applicable Standards

A GHG inventory is a list of emission sources and associated emissions quantified using standardized processes and calculation methods over a defined time period and scope of activities. GHG inventories can cover all activities in a defined geographical boundary (e.g., national GHG inventories), all activities of an organization (e.g., corporate GHG inventories), or even single activities within organizations (e.g., project or event GHG inventories). In short, GHG inventories can be elaborated for all types of purposes as long as the time period and activities they cover are well-defined. GHG inventories provide governments and organizations with the data required to identify sources and trends in emissions. With this knowledge, they can take action to develop and implement emission reduction plans in the relevant sectors or business units.

In 1996, the IPCC published the first standardized methods for countries to calculate their national GHG inventories which has been updated twice since (see IPCC, 2019). Around the same time, the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) recognized the need for standardized methods for GHG accounting for private sector organizations. According to their webpage, they launched the GHG Protocol through a multi-stakeholder process of environmental groups and industry and published the first edition of their Corporate Accounting and Reporting Standard in 2001.[1]

In this standard, they introduced the concept of GHG emission differentiation by scopes (scope 1, 2, 3) depending on where the emissions occur along the value chain. Scope 1 covers all direct GHG emissions that occur from sources that are owned or controlled by the reporting entity. These emissions typically result from the combustion of fuels on-site such as purchased fuels that are burned during the manufacturing process of a company’s products. However, scope 1 emissions extend to all types of fuels burned by the organization such as fuels used to run organization-owned vehicles. If the organization owns the building they work in, scope 1 emissions can also extend to other owned assets such as fugitive emissions from coolants used in refrigerators or air-conditioning units.

Under scope 2, organizations should report “GHG emissions from the generation of purchased or acquired electricity, steam, heat, or cooling” (GHG Protocol, 2015) It is important to note

[1] https://ghgprotocol.org/about-us

that only GHG emissions from energy generation are tracked in scope 2. Upstream emissions, or life-cycle emissions, of fuels would be tracked in scope 3, category 3 (fuel- and energy-related emissions not included in scope 1 or scope 2).

Scope 3 covers all other indirect GHG emissions that are a consequence of the reporting entity's activities but occur from sources outside of the organization's control along the value chain. These include but are not limited to purchased goods and services, business travel, employee commuting, and waste generated in operation.

Over time, the GHG Protocol compiled the most comprehensive repository of guidelines for GHG accounting and reporting. While their Corporate Accounting and Reporting Standard has not been revised since 2004 (GHG Protocol, 2004), it is still the reference of choice for organizations seeking to quantify their GHG emissions. For example, the SBTi also requires companies using their net zero standard to align their GHG inventory with the GHG Protocol Corporate Standard (SBTi et al., 2024). Furthermore, WRI and WBCSD published a number of additional guiding documents for specific emission categories (e.g., GHG Protocol, 2015), value-chain emissions (e.g., GHG Protocol, 2011) and non-private sector GHG accounting (e.g., GHG Protocol, 2021) among others. As a result of its global recognition, we also chose to follow the revised edition of the GHG Protocol's Corporate Standard to build the Wyss Academy's GHG inventory (GHG Protocol, 2004), as well as any technical or process-related guidance published by the GHG Protocol where relevant.

2.3.2 Accounting Principles

To build the GHG inventory of the Wyss Academy, we follow the five overarching accounting principles of the GHG Protocol:

- Relevance: we chose relevant boundaries for emissions reporting. The inventory should disclose all emissions relevant to stakeholders.
- Accuracy: the data used is sufficiently precise to reduce uncertainties to the minimum.
- Completeness: all relevant emission sources within the chosen inventory boundary are accounted for to the best available data. If there are no monitoring systems in place to measure emissions, it is disclosed.
- Consistency: accounting approaches, inventory boundaries and calculation methodologies are disclosed to ensure consistency over time in order to identify trends and assess performance.

- Transparency: processes, procedures, assumptions, and limitations are communicated clearly in order for external or internal verifiers to attest to its credibility.

This first attempt to compile a comprehensive GHG inventory of the Wyss Academy covers the most relevant emissions sources and uses the most precise data available. However, we acknowledge that there are emission gaps in our inventory that will have to be tackled in future reporting periods. Indeed, while this GHG inventory considers all emission sources based on available data, GHG emissions from some sources could not be quantified due to a lack of data and monitoring systems in place. This includes, among others, scope 2 emissions in the regional stewardship hubs, waste generated in operations, and purchased goods and services. Therefore, it is crucial that monitoring systems are put in place for future reporting periods.

2.3.3 System Boundaries

The Wyss Academy for Nature is involved in a variety of activities worldwide which are centered around four regional hubs. Since 2020, the Wyss Academy has started the process of establishing legal footing in its regional stewardship hubs in East Africa, South America, and Southeast Asia. In Switzerland, the Wyss Academy for Nature has been registered as foundation since 2020. In the South America hub, the Wyss Academy established a hosting agreement with the International Potato Centre in Lima and set up an office in the department of Madre de Dios in Peru in 2021. In the East Africa hub, the Wyss Academy set up an official branch office in Kenya in 2021 and a branch office in Madagascar. In the Southeast Asia hub, the formal setup was established only in 2022 through a partnership and hosting agreement with the Regional Community Forestry Training Center for Asia and the Pacific in Bangkok on the one hand, and a partnership with the Lao office of the Centre for Development and Environment of the University of Bern in Vientiane on the other hand.

Organizational Boundaries

Due to the international nature of the Wyss Academy’s operations, the inventory requires to consolidate emissions from the different branches of the organization. It is particularly important to define how to deal with Wyss Academy’s offices hosted by other organizations, which is the case in South America and Southeast Asia. Indeed, office leases and employees working for the Wyss Academy in these hubs are not directly contracted by the Wyss Academy but by the host organizations. Depending on the consolidation approach used, emissions could either be counted towards the host organization or the Wyss Academy. We chose to attribute these emissions to the Wyss Academy based on the argument below.

The GHG Protocol describes different consolidation approaches that can be used under their standard. They differentiate between an equity share approach, which is based on economic interest or shares owned in another organization, and control approaches which are based on financial or operational control in another organization. Under the equity share approach, the Wyss Academy would not count emissions from its regional stewardship hubs where it is hosted because they do not own shares in the hosting organizations. This approach is not suitable to the Wyss Academy considering its partners' legal form as foundations, international organizations, or more generally NGOs. Hence, we consolidate the Wyss Academy's emissions based on an operational control approach because it most accurately depicts the relationship between activities in regional stewardship hubs and the Wyss Academy.

Since the Wyss Academy has full control over the activities undertaken in the regional stewardship hubs, we consolidate emissions from all activities in the four regional stewardship hubs as depicted in Figure 1. It is important that this consolidation method is used consistently across future reporting periods to enable the identification of emissions trends and assess the performance of the Wyss Academy.

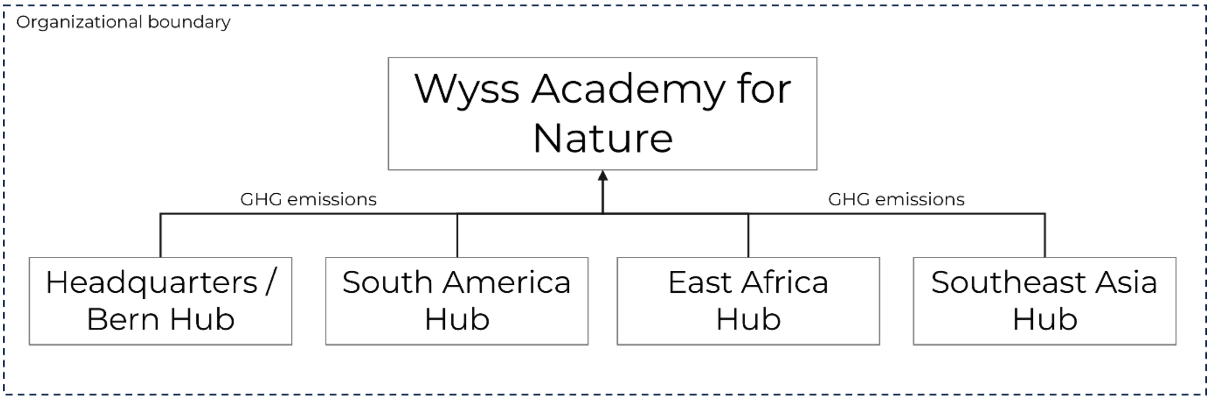

Figure 1: Wyss Academy Organizational Boundaries.
This figure shows the consolidation of GHG emissions across headquarters and all regional stewardship hubs. The Headquarters and the Bern Hub share a location which is why they are combined.

Operational Boundaries

We also defined the operational boundaries of the GHG inventory and identified relevant emission sources for the Wyss Academy. Table 1 shows the sources we were able to measure and report across all regional stewardship hubs and headquarters. We consider the emission sources presented in Table 1 to be the most relevant considering the Wyss Academy's activities. Not only do we expect these sources to represent the bulk of the Wyss Academy's GHG emissions, but they are also representative of the Wyss Academy's core activities of conducting research and implementing on the ground solutions.

Since the Wyss Academy provides services in the form of research or project implementation, Scope 1 emissions only contain vehicles owned by the Wyss Academy in the East Africa Hub. In Scope 2, we were able to gather energy consumption data from the headquarters but there are no monitoring systems in place in the regional stewardship hubs. However, we know that the offices in South America and East Africa are not heated and therefore assume that these emissions are negligeable. Scope 3 contains all emissions up and down the value chain. For scope 3, we collected data on business travel emissions and employee commute centrally. For the office in Southeast Asia, we were unable to record any data on Scope 1 and 2 emissions due to the recent establishment of the office.

			Scope 1	**Scope 2**		**Scope 3**	
	Organization type	**Property area (m^2)**	**Vehicles**	**Electricity**	**Heating**	**Business Travel**	**Employee commute**
Headquarters (Switzerland)	Registered foundation	984	NA	✓	✓	✓	✓
East Africa Hub (Kenya)	Branch office	250	✓	Unable to monitor currently	NA	✓	✓
South America Hub (Peru)	Hosting agreement	100	NA		NA	✓	✓
Southeast Asia Hub (Laos)	Hosting agreement	The Wyss Academy only recently moved into their offices. No data was communicated yet.				✓	✓

Table 1: Wyss Academy Operational Boundaries.
This table shows the emission sources and categories for which the Wyss Academy calculates and reports GHG emissions.

We summarized GHG emission sources and years for which we were able to gather emissions data in Table 2. The table shows that emissions data for the headquarters is fairly well-documented. However, emission sources for the regional stewardship hubs are currently not well monitored; hence, not quantified. In Table 2, red crosses indicate that data was not quantified, even though emissions might have occurred from this source. Empty values indicate that the Wyss Academy did not generate any emissions from that source. For regional stewardship hubs, we only consider emissions starting from the first full calendar year that the office was formally set up. In other words, if the office implementation ended during 2022, we only consider office emissions from 2023 onwards.

Available GHG emissions data by source and office

Reporting periods: 01.01.YYYY - 31.12.YYYY

	Office	2021	2022	2023
Car fleet	Headquarters	-	-	-
	South America Hub	-	-	-
	East Africa Hub	-	✗	✓
	Southeast Asia Hub	-	-	NDY
Electricity	Headquarters	✓	✓	NDY
	South America Hub	-	✗	✗
	East Africa Hub	-	✗	✗
	Southeast Asia Hub	-	-	NDY
Heating	Headquarters	✓	✓	NDY
	South America Hub	-	-	-
	East Africa Hub	-	-	-
	Southeast Asia Hub	-	-	NDY
Business Travel	Headquarters	✗	✓	✓
	South America Hub	✗	✓	✓
	East Africa Hub	✗	✓	✓
	Southeast Asia Hub	✗	✓	✓
Employee Commute	Headquarters	✗	✗	✓
	South America Hub	-	✗	✓
	East Africa Hub	-	✗	✓
	Southeast Asia Hub	-	-	✓

Table 2: Wyss Academy emissions data by emission source, office, and year.
Missing values mean that the office did not generate any emissions from that source. Red crosses indicate that emissions from this source were generated, but we are currently unable to quantify them. Green check marks indicate that emissions from that source were quantified. NDY means "no data yet" and indicates that there is currently no data available for this source in that office but is expected to be available in the future

Reporting Period Boundaries

For the Wyss Academy's GHG inventory, we determined that the reporting period should be conducted over full calendar years. This is because data on certain emission sources such as those from energy purchase are only available once a year. Furthermore, different energy products also cover different reporting periods, which renders reporting based on other yearly schedules more difficult (e.g., fiscal year).

In the context of this thesis, most analysis was conducted on GHG emissions from the year 2023 as it is more representative of the Wyss Academy's growth and future emissions than earlier years. Currently, data on energy consumption for the year 2023 is not yet available or incomplete (see Table 2). To overcome this deficit, we use energy consumption values from past years to estimate 2023 emissions. We assume that energy consumption is fairly constant because there were no office location changes, at least in Switzerland where we are able to gather energy use data.

2.4 Quantification of Emissions

Figure 1 illustrates the general methodology employed in the collection and analysis of GHG data. To build the GHG inventory of the Wyss Academy, we first collected data from the Wyss Academy's main sources of emissions through a variety of methods. Second, we cleaned and enriched the data if required. Third, we applied appropriate emission factors to calculate emissions. Although emission factors inevitably entail a degree of approximation, we have consistently employed context-specific factors that are as precise as possible given the available information.

Fourth, once information on the relevant emission sources was gathered, we moved on to the analysis of the GHG inventory by calculating various statistics, especially in the context of flight travel. This knowledge on the Wyss Academy's flight patterns allowed us to identify emission reduction opportunities in a fifth step. Specifically, we estimated the impact of potential measures and compared them to the status-quo to quantify relative emission reductions. Finally, we addressed the Wyss Academy's hard-to-abate emissions given their growth path. We conducted a review of the existing literature on this topic and provided a nuanced analysis of possible environmentally just solutions.

Figure 1: Flowchart of methodology

2.4.1 Scope 1 – Direct Emissions

The Wyss Academy leases all its office spaces, does not produce any goods and does not use any fossil fuel generated furnaces for heating. Therefore, scope 1 emissions are currently limited to the combustion of fuels in owned vehicles. The Wyss Academy currently only owns one car for its staff in the East Africa Hub. Since the East Africa Hub monitors the fuel use of this car, we were able to obtain detailed diesel consumption for this car. We then calculated GHG emissions by multiplying the volume of fuel used by the appropriate emissions factor.

2.4.2 Scope 2 – Indirect Emissions from the Purchase of Energy

Currently, no energy consumption data is available for the year 2023 across all offices of the Wyss Academy. Furthermore, we were unable to collect activity data for previous years from regional stewardship hubs due to a lack of monitoring systems. Therefore results (see Table 5) are solely based on energy consumption in the Wyss Academy's headquarters in 2022. We used the market-based approach to calculate GHG emissions by quantifying emissions based on the energy mix of the purchased product from the energy supplier (GHG Protocol, 2015, p. 26), instead of using regional grid average factors, otherwise known as the location-based approach. We can assume that these emissions are fairly similar in 2023 since the Wyss Academy still uses the same offices in Switzerland and purchases the same energy product.

Under the GHG Protocol, Scope 2 emissions may either be reported based on the composition of the energy product purchased (market-based method) or based on the average carbon intensity of the grid where the organization operates (location-based method). We opted for the market-based method as it provides a more precise image of an organization GHG emissions from energy consumption. However, this method requires that the energy product fulfills certain quality criteria.

To report scope 2 emissions using the market-based method, the GHG Protocol requires that the claims made by reporting organizations regarding the source of energy and emission factors are based on verifiable information and meet certain quality criteria. This is to ensure the environmental integrity of the market-based method. In particular, it is to ensure that claims are not double counted, especially in markets where energy end-consumers can trade with certificates.

In Switzerland, the energy-market is highly regulated. Swiss law requires that all electricity produced in Switzerland must be registered by means of *Herkunftsnachweise* (HKN), meaning guarantees of origin (HKSV, 2017). Moreover, electricity suppliers must declare the electricity mix supplied to the end consumer at least once a year and guarantee it on the basis of HKNs. This ensures a high level of transparency not only on the production side, but also on the end consumer side. Among other elements, the HKNs contain information on the amount of electricity generated, the energy sources used to produce said amount of electricity, and direct CO_2 emissions caused at the point of generation (HKSV, 2017, Article 1.2). This system ensures that the Scope 2 Quality Criteria of the GHG Protocol are met. Still, for completeness, we provide and discuss the different quality criteria as published in the guidance in Appendix A (GHG Protocol, 2015, pp. 60, 63).

As a result, even though the Wyss Academy does not possess or cancel guarantees of origin on its own, the energy provider is required to do so on their behalf. The electricity consumed and associated emission factors are guaranteed by a system that tracks and cancels certificates of origin in the form of HKNs. The Swiss Federal Office of Energy is the responsible authority for supervising electricity suppliers and ensure they own the required HKNs on which they base their reported supplier mix. This fulfills the quality criteria set out by the GHG Protocol.

Nonetheless, the structure of the Swiss system does not require energy supplier to report on some emission factors required or recommended by the GHG protocol, such as:

- HKNs do not include non-CO_2 emission factors associated with the unit of electricity generated.
- Incinerated waste for district heating is considered CO_2-neutral even if it contains fossil waste material (see BFE, 2018).

- HKN do not include biogenic CO_2 emission factors for biomass or municipal solid waste (MSW) from biogenic sources (reporting recommendation).

As a result, we analyzed the Wyss Academy's energy products to determine non-CO_2 emissions, emissions from municipal solid waste incineration, and biogenic CO_2 emissions.

Electricity Emissions

First, we collected electricity consumption data from the Wyss Academy's utility invoices, which also gave us the electricity product purchased. Second, we determined the composition, or electricity mix, of the product from the energy provider's website (EWB, n.d.). Four different renewable energy sources were identified: hydroelectric power (80%), solar power (10%), biomass (5%), and biogenic MSW (5%). Third, we allocated the Wyss Academy's total energy usage proportionally to each source, which revealed the yearly energy consumption per energy source. Fourth, we attributed emission factors to each energy source from the Swiss National Greenhouse Gas Inventory (FOEN, 2023b). In accordance with the guidance from the GHG Protocol, only emissions arising from the generation of energy were taken into consideration. The incineration of biomass and biogenic MSW was categorized as CO_2-neutral. As a result, we restricted our evaluation to methane (CH_4) and nitrous oxide (N_2O) emissions from the aforementioned incineration processes. Finally, we converted these non-CO_2 emissions to CO_2e with GWP-100 values from the IPCC (2021).

Heating Emissions

Since the Wyss Academy's Bern office is connected to the municipality's district heating network, we could collect the data on heat consumption from the Wyss Academy's utility invoice once again. The purchased heating product contained MSW (50.3%), biomass (34.1%), and natural gas (15.6%).

Under Swiss regulations, energy suppliers can market the heat from the incineration of MSW as producing zero CO_2 emissions even though it contains a share of fossil waste (BFE, 2018). This is because heat from MSW incineration is considered secondary heat that is repurposed. It would be different if energy suppliers were to use secondary heat as a means to produce electricity. In this case, the CO_2 emissions would have to be disclosed. However, even if purchased heat is a waste product from another facility as is the case here, the GHG Protocol states that "accurate emissions accounting requires the actual emissions with the production of this waste to be reported" (GHG Protocol, 2015, Appendix A).

Thus, the emission factors published by the Wyss Academy's energy provider (EWB, 2024) do not consider some GHG emissions that we must report under the GHG Protocol. Therefore, we used emission factors from Switzerland's National Inventory Document (SNID). We chose to use emission factors from SNID because it contains measured emission factors from Swiss MSW incineration facilities. In particular, SNID contains measurements regarding the share of fossil and biogenic material found in Swiss MSW. For consistency, we also used emission factors for the incineration of biomass and natural gas from SNID (FOEN, 2023b, Tables 3–32, 3–33, 3–34).

We followed the same approach as for electricity to calculate GHG emissions but added an additional step in our calculation. We attributed the Wyss Academy's total heat consumption proportionally to each energy source. Then, we applied emission factors for CO_2, CH_4, and N_2O from SNID to all energy sources. However, this result also included biogenic CO_2 emissions from the incineration of biomass and the share of biogenic waste in MSW, which are considered carbon neutral and should not be included in our reporting. Consequently, we multiplied CO_2 emissions by the share of fossil material contained in each source. To summarize, CO_2 emissions were calculated for each energy source as follows:

$$kg_{fossil}CO_2 = MWh \cdot Fossil\ (\%) \cdot kgCO_2/MWh$$

The fossil share of MSW as well as emission factors are based on measurements of Swiss MSW incinerators (FOEN, 2023b). CH_4 emissions from MSW incineration are not significant due to the high temperature of incineration. Non-CO_2 emissions were converted to CO_2e with GWP-100 values from IPCC (2021).

2.4.3 Scope 3 – Other Indirect GHG Emissions

Air travel Emissions

We collected all air travel data from the Wyss Academy's booking platform, which records all flights from employees and external stakeholders centrally. The booking platform logs each flight and includes data such as the name of the passenger, the ticket number, the departure date, arrival and departure airports, the distance, the booking class, and GHG emissions. We exported the data from the booking platform for the year 2023 to an Excel file which contained 856 recorded flights. We imported this dataset into the integrated development environment RStudio and used the programming language R to work on the data.

After carefully reviewing the datapoints, we identified several shortcomings in the original dataset. These deficiencies included the inclusion of duplicate, rebooked and cancelled flights, which resulted in an overestimation of the total GHG emissions associated with air travel. First, we deleted four duplicate flights with same ticket number, as well as the same arrival and departure airport. Second, we applied a custom sorting function to ensure that multi-legged journeys would be displayed in the right order. Third, we developed a code that flagged any flight departing from another airport than the previous arrival airport. This allowed us to reveal any travel inconsistencies in the data. Fourth, we manually controlled all flight inconsistencies and deleted those flights that were determined to be falsely included. Out of 167 flagged flights, we identified 146 flights that were mistakenly included in the dataset. This left a total of 710 flights for our analysis.

In the data provided by the booking platform, the GHG emissions for each flight are based on the methodology of myclimate, a Swiss foundation providing consulting, education and climate protection projects. While we defer to myclimate's documentation for a detailed description of their methodology (cf. myclimate, 2024), Figure 2 provides a clear overview of steps taken to calculate passenger emissions for a flight.

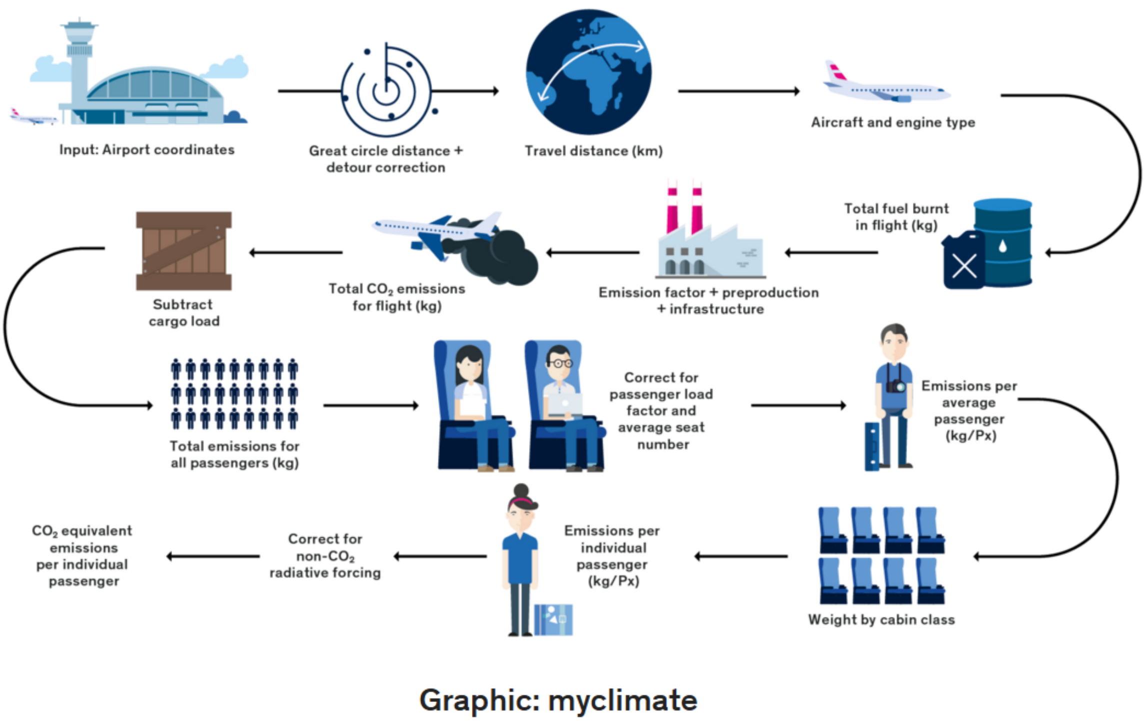

Figure 2: Overview myclimate methodology for flight passenger emissions

It can be observed that the total fuel burnt is not only based on distance, but also on aircraft type. We can also see that infrastructure and fuel pre-production are factored in to calculate total CO_2 emissions for each flight. Emissions per passenger are also based on whether the aircraft carries cargo and on an average passenger load factor, i.e. considering that not all planes fly at full seating capacity. Furthermore, the cabin class is also considered as business or first class seats take up more space in an aircraft and are consequently responsible for a higher share of total GHG emissions.

It is also important to note that non-CO_2 effects, such as nitrogen oxides (NO_x), water vapor, soot and sulfate aerosols, as well as the effect of clouds due to contrail formations, are incorporated in their calculation. In line with recommendations from latest studies (D. S. Lee et al., 2021), myclimate uses a factor of 3 by which to multiply total aircraft CO_2 emissions to account for the non-CO_2 effects of aviation.

We compared myclimate's methodology to the methodologies of the Travel Impact Model (Google Flights) and atmosfair to ensure that myclimate was not over- or underestimating GHG emissions. We have found that the Travel Impact Model does not incorporate non-CO_2 effects in their model (Google, 2022). This does not correspond to a far-sighted scientific approach in our opinion as non-CO_2 effects represent a considerable portion of aviation's climate impact. The methodology applied by atmosfair presents a similar approach to myclimate. While atmosfair does not incorporate GHG emissions from infrastructure, such as airports or runway maintenance, they weigh non-CO_2 effects more strongly on long-haul flights due to the higher flight altitude (atmosfair GmbH, 2023). As a result, atmosfair's estimation for GHG emissions tends to be higher for long-haul flights than myclimate's, while myclimate estimates higher GHG emissions for short-haul flight than atmosfair. Following a thorough evaluation, it was determined that the other approaches were not superior to myclimate's methods. For this reason, the decision was made to proceed with the latter for the Wyss Academy's GHG inventory.

Rail Travel Emissions

The most straightforward approach for calculating GHG emissions from rail travel is to multiply the total distance travelled by the passenger by the emission factor that corresponds to this specific mode of transportation:

$$Emissions_{gCO_2e} = Distance_{km} \times \frac{gCO_2e}{pkm}$$

In the context of this thesis, we determined the distance that employees of the Wyss Academy travel by train and multiplied it by an emission factor corresponding to the average GHG emissions produced by a train passenger per kilometer.

Rail travel at the Wyss Academy is recorded centrally with their partner from the Swiss Federal Railways (SBB). As a corporate client, the Wyss Academy is provided with a comprehensive overview of all rail journeys undertaken by their employees over a specified time period. Information on 453 rail journeys undertaken between 1 January and 29 November 2023 was obtained. The communicated information included, but was not limited to, the date of travel, the departure station, the arrival station, the traveler, and the price. While the information provided by the SBB could have permitted a thorough analysis of rail travel patterns and costs, the data did not record track distance of the journey, which is essential to calculate GHG emissions.

In the absence of distance data in the SBB dataset, alternative methodologies for estimating the distance travelled for each rail journey were developed. The initial approach involved estimating the distance between the departure and arrival railway stations based on their geographical coordinates. However, this approach would have yielded inaccurate results, given that railway tracks are not constructed in a linear fashion.

A second option was to use road distance as a proxy for track distance, as this information can be obtained from common tools such as Google Maps. This method yielded better results since tracks and roads often follow the same transport corridor. However, we determined that there were still too many approximations involved.

Ultimately, we determined that the Open Journey Planner (OJP) Interface was the best option for acquiring precise distance-related information on employees' public transport journeys[2]. The OJP is a complimentary Application Programming Interface (API), made available by the Open Data Platform Mobility Switzerland, which is operated by the SBB. The OJP enables users to submit "trip requests" based on Swiss departure and arrival public transport stations. In return, the application provides real-time information on the various travel options from one place to another. Despite the similarities between the OJP and the SBB mobile application, the former includes information on the distance travelled, which permits an estimation of GHG emissions per trip.

[2] The Open Journey Planner is available online at https://opentransportdata.swiss/en/dataset/ojp2020

Using the programming language R, we wrote a script that allowed us to send trip requests for all public transport journeys undertaken by Wyss Academy employees. First, we added the official unique identifier (UID) to each public transport station from the SBB's open source datasets (SBB, 2024).

Second, we built a function to generate XML documents for each trip, which would facilitate the submission of API requests. The construction of each XML document was based on the formal requirements for sending API requests to OJP, including the API key and individual token, as well as the information contained in each row of the Wyss Academy dataset. Specifically, this included the departure station UID, the departure station, the arrival station UID and the arrival station. Given the unavailability of historical data within the system, the departure date and time were set to the current time.

Third, we built a function to extract the information related to the track distance from the API response. The OJP API consistently provides multiple travel options which may differ in route, duration and distance travelled. In the absence of precise information on the Wyss Academy employees' route, we assumed that travelers would choose the option with the shortest duration. While this may not be an exact reflection, it is reasonable to infer that travelers may prioritize time over other factors. Therefore, we enriched the original dataset with the travel distance associated with the shortest trip duration.

Fourth, the dataset comprised 34 rail journeys that crossed international borders. It was not possible to ascertain the distance of these trips from the OPJ, as the system is only operational within the borders of Switzerland. Consequently, the road distance was used as a proxy for track distance and these values were manually appended to the dataset.

We then applied emission factors specific to Swiss, French, German, and Italian rail depending on the rail journey. We used a tool created by The Paul Scherrer Institut (2023) which provides life cycle emission factors for passenger and freight transport vehicles for Switzerland and a few European countries. The emission factors not only take into direct emissions but also up- and downstream emissions such as energy transmission and distribution losses, vehicle maintenance, end-of-life treatment, and infrastructure.

For Swiss railways, we used an average emission factor for regional and long-distance traffic. For other European railways, we used country-specific emission factors for high-speed trains. Table 16 shows how we applied emissions to different rail journeys. If the train crossed a border into a neighboring country, we used the non-Swiss emission factor to ensure a conservative estimate of total GHG emissions.

Employee Commuting

Employee commuting is included in the GHG inventory because commuting to and from the office is a necessary part of an organization's functioning. Even though the Wyss Academy does not consume or reimburse expenses from commuting to the office, it is still responsible for their generation of GHG emissions as an employer (GHG Protocol, 2011).

We collected activity data by asking all employees to fill out a Microsoft Forms survey regarding their commuting behavior. We asked employees for their place of work, approximate distance from their home to their office in kilometers, the number of days working at the office per week, and the main form of transportation they use to go to the office. If the employee usually travels by car, we also asked the model of the car, the year, and the fuel type (see Appendix G: Questionnaire Employee Commuting).

For each respondent, we multiplied the distance between their home and their office by two to account for the return journey. We multiplied this distance by the number of days this employee spends at the office per week. We then multiplied the distance commuted per week by 45 to obtain the commuting distance per year for each employee. This accounts for five weeks of vacations and two weeks of public holidays (9 days in Bern). For each mode of transportation and geographical location, we used an emission factor to calculate total GHG emissions for each employee.

From our sample of 50 respondents, we extrapolated results to estimate commuting distance and GHG emissions for all 94 Wyss Academy employees. We used the average commuting emissions by office for our sample and multiplied it by the actual number of employees in this office.

3 RESULTS

3.1 GREENHOUSE GAS INVENTORY

Table 3 summarizes the Wyss Academy's GHG emissions over time by emission sources. We observe that the Wyss Academy's total GHG emissions increased by approximately 250 t CO_2e from 2022 to 2023. Business travel accounts for over 94% of this increase with an additional 235 t CO_2e emitted in this category. The inclusion of two new categories, emissions from owned cars and employee commute, only account for 6% of this increase.

It must be noted that we expect scope 2 emissions to be higher than portrayed in Table 3 (red values) due to an increase in staff and offices. Since the Wyss Academy moved into new offices in its regional stewardship hubs where we lack information on electricity consumption, we expect Scope 2 emissions to be higher than currently shown. For 2023, we used values from past energy use in the headquarters because we could not gather complete energy consumption data from any Wyss Academy office.

Summary of GHG emissions over time

Reporting periods: 01.01.YYYY - 31.12.YYYY

	Source	2021	2022	2023
Units	-	*t CO_2e*	*t CO_2e*	*t CO_2e*
Scope 1	Car fleet	-	-	6.421
Scope 2	Electricity	0.006	0.006	0.006
	Heating	12.049	12.049	12.049
Scope 3	Business Travel	-	178.023	413.803
	Employee Commute	-	-	7.550
Total	**-**	**12.055**	**190.078**	**439.829**

Table 3: Wyss Academy GHG emissions from 2021 to 2023 by emission source.
We summarized GHG emissions from all available sources (see Table 2) in tons of carbon dioxide equivalent. Red values for electricity and heating indicate that emissions data was not available or incomplete and that emission values are based on the previous year.

In 2023, the Wyss Academy emitted around 440 t CO_2e. Figure 3 shows the distribution of these emissions by scopes. The vast majority of emissions originated from business travel, in particular air travel. In second place, purchased energy accounted for 2.74% of total GHG emissions in 2023. Employee commute and direct emissions from owned assets only accounted for 1.72% and 1.46% of total GHG emissions respectively.

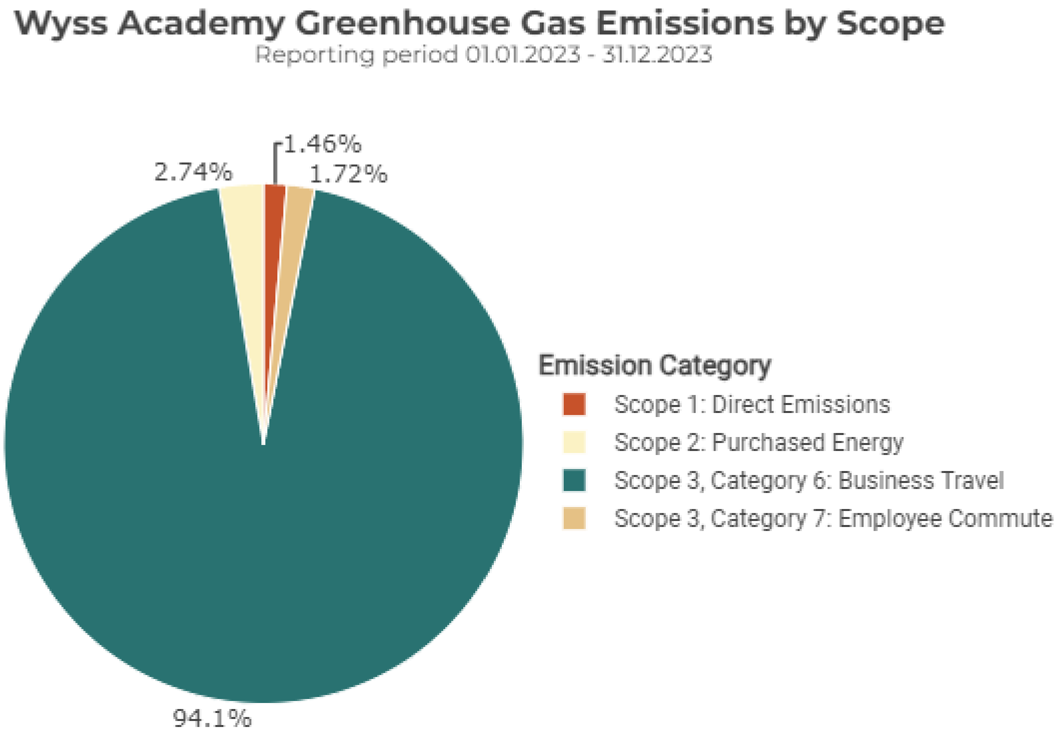

Figure 3: Wyss Academy GHG emissions by Scope in 2023.

3.1.1 Scope 1 – Direct Emissions

The Wyss Academy's scope 1 emissions are currently limited to the combustion of fuels in owned vehicles. Table 4 summarizes the Wyss Academy's scope 1 GHG emissions from the

Scope 1: Direct Emissions

Reporting period 01.01.2023 - 31.12.2023

Activity Data				Emission factors		Emissions		
Source	Fuel	Volume	Mass	CO_2	N_2O	CO_2	N_2O	CO_2e
Units	*-*	*Liter*	*kg*	*kg CO_2 / kg fuel*	*g N_2O / kg fuel*	*t CO_2*	*kg N_2O*	*t CO_2e*
Vehicle	Diesel	2'400	2'011.2	3.169	0.087	6.373	0.175	6.421
Total						**6.373**	**0.175**	**6.421**

Table 4: Wyss Academy Scope 1 GHG emissions in 2023.
The Wyss Academy owns one car in its office in East Africa. CO_2 emission factors are based on an assumed 100% oxidation of the fuel carbon and N_2O emission factors are based on mean N_2O emissions of passenger cars (European Environment Agency, 2023).

combustion of fuels in vehicles. We observe that emissions from owned vehicles amounted to 6.421 t CO_2e in 2023.

3.1.2 Scope 2 – Indirect emissions from the purchase of energy

In Table 5, we observe that the Wyss Academy consumed 128.501 MWh of energy which emitted 12.055 t CO_2e. Electricity emissions stood at around 6 kg CO_2e since it is only generated from renewable energy sources and biogenic materials (see Appendix B: Detailed Electricity Emissions). As a result, electricity emissions only represented a marginal percentage of total emissions. Considering an average emission intensity of Swiss passenger cars of 169.8 g CO_2e per vehicle-kilometer (FOEN, 2023a), GHG emissions from the purchase of electricity represent a car ride of approximately 35 kilometers. In contrast, emissions from heating are considerably higher at 12 t CO_2e. This contrast is not unexpected since the Swiss electricity grid has one of the lowest GHG intensities in the world, but the climate in Bern requires offices to be heated 218 days a year (Stadt Bern, 2023).

Scope 2: Indirect emissions from purchased energy

Reporting period 01.01.2022 - 31.12.2022

	Activity Data		Emissions Factors			GHG Emissions			
	Units	MWh	kg CO_2/MWh	g CH_4/MWh	g N_2O/MWh	t CO_2	kg CH_4	kg N_2O	t CO_2e
HQ / Hub Bern	Electricity	21.842	-	0.072	0.923	-	0.002	0.020	0.006
	Heating	106.659	111.025	1.053	7.013	11.842	0.112	0.748	12.049
Hubs South	Electricity	NA	-	-	-	-	-	-	-
	Heating	NA	-	-	-	-	-	-	-
Total	**-**	**128.501**	**-**	**-**	**-**	**11.842**	**0.114**	**0.768**	**12.055**

Table 5: Wyss Academy Scope 2 GHG emissions from the purchase of energy in 2022.
Emission factors presented in Table 5 are averaged based on energy sources used for the generation of energy. Detailed emission factors for each source area in Appendix A: Detailed Electricity Emissions and Appendix B: Detailed Heating Emissions.

Furthermore, it must be noted that the headquarters are connected to the city of Bern's district heating network which is mainly powered by the combustion of municipal solid waste (MSW). Although this source of energy is fairly CO_2 intensive, it permits repurposing heat from a source that would generate the same amount of GHG emissions with or without energy recovery. It can be argued that such waste-to-energy systems avoid GHG emissions from alternative heating fuels. Nevertheless, accurate emissions accounting requires that we include all emissions associated with the combustion of the materials used for the generation of heat. The exact composition of the district heating product is presented in Appendix C: Detailed

Heating Emissions. Moreover, we also report biogenic CO_2 emissions from the generation of purchased energy in Appendix D: Biogenic CO_2 Emissions.

3.1.3 Scope 3 – Other indirect GHG emissions

The GHG Protocol differentiates between fifteen categories of scope 3 emissions and provides technical guidance for calculating emissions in each category (GHG Protocol, 2013). Currently, the Wyss Academy reports emissions for category 6, business travel, and category 7, employee commute.

Category 6: Business Travel

Business travel considers all GHG emissions from the transportation of employees for business-related activities in vehicles owned or operated by third parties (GHG Protocol, 2013). Currently, the Wyss Academy monitors activity data for business air and rail travel centrally. Therefore, high quality data for the calculation of GHG emissions is available for these transport modes.

GHG emissions from business travel are presented in Table 6. In total, we recorded 710 flights and 453 train journeys in 2023 which covered more than 2.3 million kilometers and emitted 413.8 t CO_2e. Air travel represents close to 100% of total GHG emissions in this category with 413.29 t CO_2e, whereas GHG emissions from rail travel are marginal in comparison with 0.51 t CO_2e.

Scope 3, Category 6: Business Travel
Reporting period 01.01.2023 - 31.12.2023

	Trips		Distance		Emissions	
Units	*%*	*n*	*%*	*km*	*%*	*t CO_2e*
Flights	61.05	710	98.00	2'307'931	99.88	413.29
Below 700 km	15.48	180	3.81	89'728	6.77	28.03
Above 700 km	45.57	530	94.19	2'218'203	93.10	385.26
Rail	38.95	453	2.00	47'140	0.12	0.51
Europe	1.72	20	0.39	9'105	0.06	0.24
Switzerland	37.23	433	1.62	38'035	0.06	0.27
Total	**100.00**	**1'163**	**100.00**	**2'355'071**	**100.00**	**413.80**

Table 6: Wyss Academy Scope 3, Category 6: Business Travel GHG emissions in 2023.
Emissions from business flights are communicated directly to the organization through its travel agency. Calculations are based on the calculation tool developed by myClimate. Rail emission factors are specific to European and Swiss railways (Paul Scherrer Institut, 2023). Detailed rail emissions are presented in Appendix E: Detailed Emissions from Rail Travel

In Table 6, we separated air travel into flights covering a distance below or above 700 kilometers. We use this differentiation because distances below 700 kilometers may potentially be replaced by another mode of transportation such as rail travel (Anders Reizen & Natuur&Milieu, n.d.). Despite long-haul flights being responsible for 93.10% of total travel-related GHG emissions, short-haul flights represent a quarter of all flights taken within the Wyss Academy. Therefore, there is potential, albeit limited, for reduction in this area by considering other modes of transportation for short-haul flights. Nevertheless, the bigger potential in reducing flight-related GHG emissions lies within reducing long-haul flights altogether.

On the positive side, almost 40% of all business trips were undertaken by rail travel. While most train trips were taken within Switzerland, some train trips were also taken within Europe. However, train journeys represent only 2% of all kilometers travelled.

Category 7: Employee Commuting

Scope 3, Category 7: Employee Commuting

Reporting period 01.01.2023 - 31.12.2023

Office	Employees	Distance	Emission factor	Emissions
Units	*n*	*km/year*	*g CO_2e/km*	*t CO_2e*
Headquarters	75	737'974	0.173	0.128
Hub South America	10	43'500	106.759	4.644
Hub East Africa	7	22'050	123.714	2.728
Hub Southeast Asia	2	3'600	14.000	0.050
Total	**94**	**807'124**	**9.354**	**7.550**

Table 7: Wyss Academy Scope 3, Category 7: Employee Commuting Emissions in 2023.
This table shows commuting, distance, average emissions intensity of commute, and GHG emissions for each Wyss Academy office. We estimated GHG emissions for the whole Wyss Academy based on a sample of 50 employees. GHG emissions only consider "use-phase" emissions and no upstream or downstream emissions.

Table 7 shows GHG emissions from employee commute. With 75 employees, the headquarters show the greatest commuting distance per year, as expected. However, the location of the headquarters and available public transport infrastructure results in a low GHG intensity. As a result, employee commute to the headquarters only generated 128 kg CO_2e in 2023. We also see that the majority of GHG emissions resulted in the East Africa and South America hubs where reliance on passenger vehicles is greater. Together, they account for 7.372 t CO_2e out of a total of 7.55 t CO_2e employee commute emissions. In the Southeast Asia hub, the Wyss Academy had only a few local employees. Therefore, GHG emissions were reasonably low at 50 kg CO_2e.

Figure 4 provides a more detailed view of the transport modes Wyss Academy employees used. We see that most employees opted for public transport or lived close enough to walk and bike to the office. In fact, most commuting kilometers were undertaken by rail, whereas cars and motorbikes only represented a fraction of total commuting distance but were responsible for the great majority of GHG emissions.

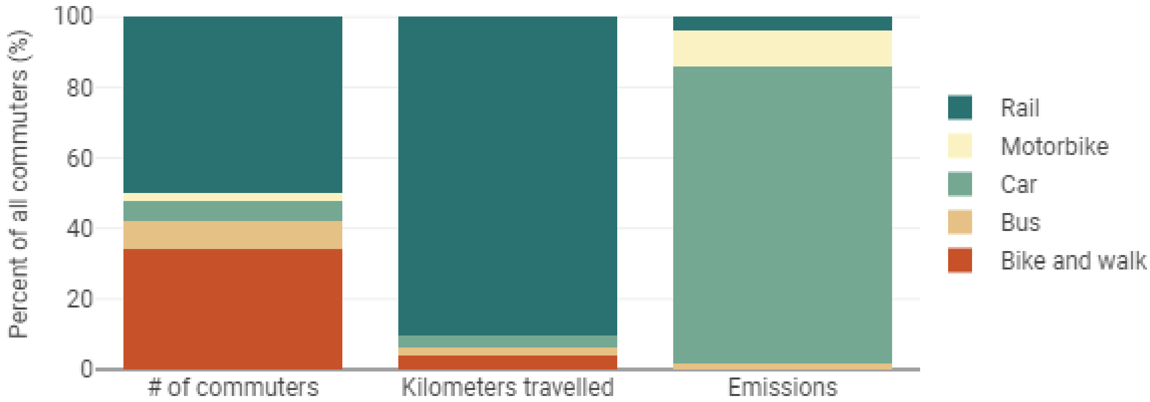

Figure 4: Wyss Academy Scope 3, Category 7: Employee Commuting Emissions in 2023.
This figure shows commuting behavior of Wyss Academy employees based on their preferred transport mode.

3.2 Emission Reductions

Based on the results from the GHG inventory, we now explore the Wyss Academy's options to reduce its environmental footprint. We must address in priority options to reduce emissions since compensation and contributions should serve as a last resort when reduction options are exhausted. This is echoed by the SBTi which requires companies that pledge net zero under their framework to set reduction targets that are in line with the IPCC's 1.5°C pathways before resorting to any form of emission neutralization or offsetting. Traditionally, these so-called science-based targets aim to achieve net zero emissions by 2050 with additional recurring short-term (5-10 years) targets to ensure steady emission reductions (SBTi et al., 2024).

3.2.1 Emission Reduction Target

To guide this process, we decided to follow the *1.5°C Business Playbook* developed by the Exponential Roadmap Initiative (ERI). The ERI serves as an alternative to SBTi which is open to all types of organizations. We chose the ERI for two reasons. Firstly, it has the ambitious target of halving emissions by 2030 and achieving net zero already by 2040. Secondly, it is open to businesses as well to other types of organizations such as the Wyss Academy. The ERI is built around four pillars (Falk, 2023):

1. Halve scope 1 and 2 emissions before 2030 and target net zero by 2040.
2. Halve scope 3 emissions before 2030 and target net zero by 2040.
3. Integrate climate into the vision, mission, and Research & Development (R&D) of the organization.
4. Contribute to the 1.5°C ambition in society beyond the organization's value chain.

Since pillars three and four are already at the core of the Wyss Academy's *raison d'être*, we focus on recommending emission reductions options to achieve pillars one and two.

Figure 5 shows the Wyss Academy's current emissions per full-time equivalent (FTE) and reduction path to halve emissions across all identified emissions sources by 2030. Since the Wyss Academy is in a growth phase, emissions have steadily increased until 2023. Currently, we expect the Wyss Academy to continue to grow as it implements its office in Southeast Asia which may result in additional staff and emissions. Furthermore, 2023 emissions might be underestimated due to lack of data. However, these values may be adjusted retroactively to account for the increase. Therefore, the Wyss Academy could use 2023 as a base year against which to calculate emission reduction targets. Given the expected further emission increase in

2024, this sets an ambitious target, reflecting the aspiration of the Wyss Academy to become a leading organization in the field of sustainability.

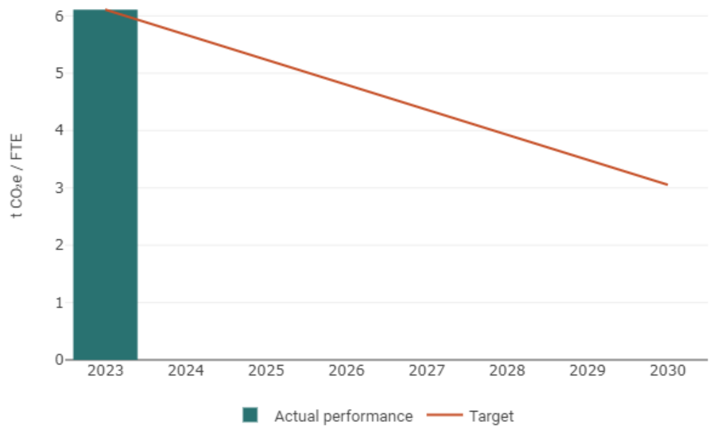

Figure 5: Wyss Academy current GHG performance and reduction target.

Given the anticipated growth of the Wyss Academy's staff and operations, we believe it is crucial for an ambitious target to remain realistic. Therefore, while targets are set based on 2023 emissions, we normalize values per FTE to account for the projected growth in the workforce. Figure 5 shows the reduction path the Wyss Academy should follow to stay in line with its commitment based on 2023 emissions by FTE. From 6 t CO_2e / FTE in 2023, the Wyss Academy should decrease its emissions to 3 t CO_2e / FTE by 2030 in a linear fashion. Targeted GHG emissions include direct and most manageable indirect sources of GHG emissions: energy consumption and business travel.

3.2.2 Reducing Energy Emissions

Currently, energy consumption data is available for the Wyss Academy's headquarters. Therefore, our focus is on the reduction potential of reducing energy consumption in the office on one side and reducing emissions from energy consumption on the other side.

Electricity

If we consider emissions from electricity, we determined that the reduction potential is low since GHG emissions from electricity generation were estimated at 6 kg CO_2e in 2022. Still, the Wyss Academy has options to reduce emissions from the purchase of electricity to 0 kg CO_2e.

In the city of Bern, the city-owned energy provider, *Energie Wasser Bern* (EWB), has a monopoly on electricity supply for consumers below 100'000 kWh per year. Since the Wyss Academy falls below this threshold, it cannot choose between different energy providers. However, the Wyss Academy may select between different electricity products offered by the EWB. The EWB sells three electricity products which are produced using only renewable energy sources from Switzerland. Currently, the Wyss Academy purchases the default product offered by the EWB. As we can see in Figure 6, the mix mostly consists of hydropower and solar energy, but it also includes the combustion of biomass and biogenic Municipal Solid Waste (MSW). While the product is CO_2 neutral, the latter two sources produce methane and nitrous oxide emissions which are responsible for the 6 kg CO_2e emitted by the Wyss Academy.

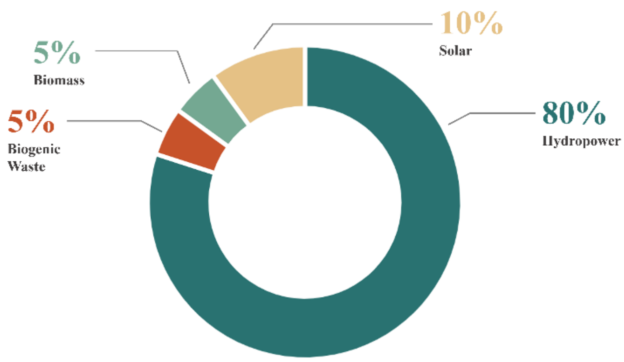

Figure 6: Wyss Academy electricity mix of purchased product.

The EWB also sells other electricity products which do not produce any GHG emissions at the point of energy generation. In particular, their "eco product" (ewb.Öko.STROM) is produced using only solar and hydropower. Furthermore, the product is labelled "*naturmade star*" which ensures that part of the revenues fund restoration projects close to the energy generation facilities. Although switching to a more ecological electricity product will only decrease yearly GHG emissions by 6 kg CO_2e, it is a low hanging fruit which requires minimal effort at an increased cost of only around CHF 300, or 7%, according to EWB's energy price calculator.

Heating

For its headquarters, the Wyss Academy purchases district heating from the EWB. In a district heating network, a central location produces heat and distributes it in a local area. This enables a region to decarbonize the heating sector rapidly since fuels can be replaced centrally without the need to replace fossil fuel generated heaters in buildings. However, buildings connected to the network do not have much flexibility with respect to the fuels used for heating. For example, the EWB only offers two products that customers can choose from.

Currently, the Wyss Academy emits about 12 t CO_2e (see Table 5) per year by purchasing the default heating product depicted in Figure 7. The fuel mix includes MSW, biomass and natural gas. GHG emissions occur from the combustion of all three fuel sources since biomass produces non-CO_2 emissions and MSW contains shares of fossil and biogenic waste. Furthermore, the energy quantity required to heat the headquarters is five times larger than the quantity of energy required to power the building (see Table 5). Therefore, the difference in emissions between the two energy requirements is a logical consequence.

EWB also offers an "eco product" in its heating portfolio wherein they exclude natural gas from their production mix and only incinerate biomass and MSW. We estimate that emissions could be reduced by 16% simply by purchasing this product. This action can again be considered a low hanging fruit which does not require great effort to implement.

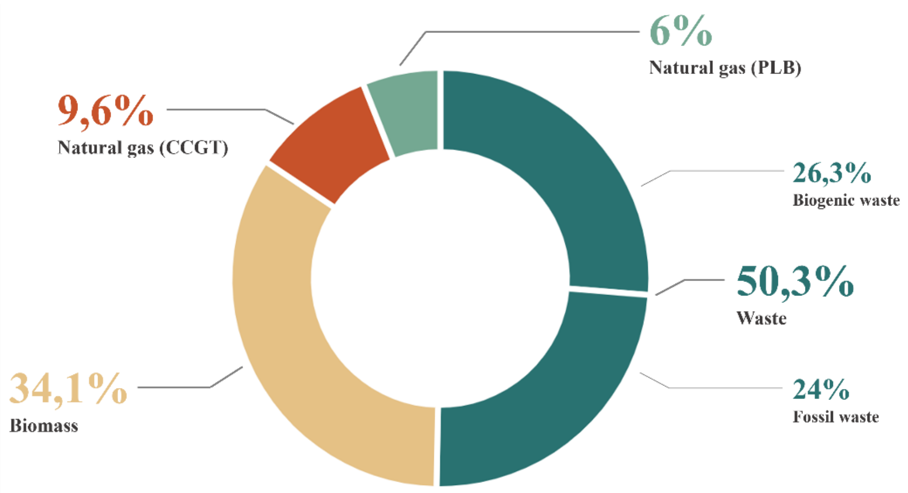

Figure 7: Wyss Academy fuel mix of purchased heating product.

However, further decreases in GHG emissions within the district heating network are limited. Reducing the share of MSW in EWB's production mix would help reducing emissions from heating. However, the incineration of MSW with energy recovery is a legal requirement in Switzerland when it has a lower environmental impact than other options (VVEA, 2015, Articles 10, 12). Given that the total quantity of MSW in Switzerland has remained fairly constant since 2016 (FOEN, 2023b, tbl. 3–36), we expect the quantity of MSW in EWB's production mix to remain constant too. Furthermore, EWB has no incentive to reduce the share of MSW in their production mix because energy generators can market heat from MSW incineration as CO_2 neutral under Swiss regulations (BFE, 2018). That is because it is considered to be secondary or waste heat from another process that is repurposed. Therefore, we can predict with high confidence that EWB will continue to supply heat with their whole stock of MSW.

An alternative to reduce GHG emissions from heating would be to consider the installation of an electricity powered heat pump. This would reduce organization wide scope 2 emissions considering the low GHG intensity of the local electricity grid. However, such a change in energy delivery may not only induce additional investment costs but also GHG emissions of its own. Among others, this would considerably increase electricity demand and associated emissions from power generation, as well as generate GHG emissions from building and installing heat pumps. All the while, emissions from MSW remain constant due to the legal requirements in Switzerland. In the worst-case scenario, EWB might have to allocate some fossil MSW to its electricity product to compensate for the increased demand in electricity. As a result, switching to heat pumps might be a sound alternative to reduce GHG emissions within the Wyss Academy, but it would not necessarily reduce GHG emissions within the local electricity and heating grid.

In addition, we need to consider that incinerating MSW with energy recovery remains the environmentally soundest alternative for dealing with waste when recycling is not an option. Since GHG emissions from MSW incineration are currently unavoidable due to legal requirements, we assume that utilizing its secondary heat as an energy source is the best environmental option. Although it produces scope 2 GHG emissions for the Wyss Academy, substituting this energy source would ignore the greater environmental impact.

Finally, the association of municipal solid waste incinerators have agreed with the Swiss Federal Department of the Environment, Transport, Energy and Communications to install carbon capture and storage (CCS) technology until 2030 with a capture capacity of at least 100'000 t CO_2 (Vereinbarung UVEK und VBSA, 2022). This CCS potential does not need to be implemented in every facility but among all waste incineration facilities in Switzerland. While the current pilot project is planned for a facility in Linth in the canton of Glarus and will only be implemented in Bern at a later stage, it shows that there is also emission reduction potential in other district heating networks. The Wyss Academy could discuss this issue with its energy provider. Considering their relationship with the city and the canton of Bern, they could advocate for the construction of CCS technology in the waste incineration facility of Bern.

To summarize, the Wyss Academy can reduce its scope 2 emissions by approximately 16% by switching to EWB's ecological heating product. The increased cost is approximately 4.22 cents per kWh, or 36%. The threshold for implementation is quite low as it only requires the Wyss Academy to contact its energy provider. Alternatively, the Wyss Academy could install heat pumps in its headquarters. However, considering that the Wyss Academy does not own the building, this approach requires lengthy discussions with the landlords. Moreover, careful consideration needs to be taken when evaluating the reductions in GHG emissions such a substitution would bring as heat pumps might require higher energy inputs to heat the building.

3.2.3 Reducing Flight Emissions

Business travel is the Wyss Academy's biggest source of emissions as it represented more than 94% of total GHG (see Figure 3) emissions and generated 414 t CO_2e emissions in 2023 (see Table 3). We saw that close to 100% of business travel emissions are a result of air travel (see Table 6). Therefore, we focused considerable resources in thoroughly analyzing flight patterns and flying behavior to identify emissions reduction opportunities. In addition, we integrated employees' perspective into our analysis through a survey.

The Wyss Academy's mission to transform scientific knowledge into action by implementing concrete projects in four regional hubs requires some amount of flying. Nevertheless, there are options to reduce emissions from air travel.

The aviation sector is working towards more sustainable operations, but the decarbonization of the aviation is still a long way off (Esqué et al., 2023). Currently, the most effective way to reduce emissions is by reducing the amount of air travel. Concretely, the most effective measures to reduce emissions from air travel are: (1) shifting to videoconferencing as much as possible, (2) shifting to rail travel where possible, and (3) considering the balance between GHG emissions and mission-relevance when making a travel decision.

The Wyss Academy already has a travel policy that requires employees to consider these factors when booking a business trip. However, we asked employees whether they consider it easily understandable and 35% of respondents answered that some parts are not very clear, even though 89% of respondents state that they consider the travel policy every time before booking a trip. While most uncertainties were related to working time during travels, one employee raised uncertainties regarding the duration threshold when it was allowed to fly instead of taking the train. Currently, the travel policy sets out four guiding principles:

1. Travel only if physical presence is required and virtual meetings are not an alternative.
2. Travel less often, stay for longer.
    a. Minimum stays of 5 days for continental flights.
    b. Minimum stays of 7 days for intercontinental flights.
3. Minimize number of people travelling.
4. Travel as environmentally friendly as possible.
    a. Prioritize trains when travel duration is below 8 hours or 12 hours for overnight trains.
    b. Direct flights where possible.
    c. Default economy class.

While this framework provides an excellent starting point for reducing flight emissions, it seems that it is not always upheld. Short-haul flights, which we defined as flights below 700 kilometers, represent a quarter of all flights (see Table 6). These trips could theoretically be replaced by trains depending on the availability of rail options.

Short-haul flights

In Table 8, we look at the main routes with distances below 700 kilometers. We see that 93 or more than half of all short-haul flights are flown in Europe, especially from Switzerland to so-called Hub Airports which connect flights to additional destinations. The main Hub Airports on continental Europe are located in Amsterdam, Paris, and Frankfurt. It is no surprise then that connections from Switzerland to these Airports belong to the most flown routes by the

Most frequented flight routes below 700 kilometers

	Flights	GHG Emissions	Relative to total emissions
Units	*n*	*t CO_2e*	*%*
Europe			
Amsterdam ↔ Zurich	31	4.991	1.21
Frankfurt ↔ Zurich	19	2.295	0.56
Other routes	14	1.881	0.46
Paris ↔ Zurich	11	1.621	0.39
Geneva ↔ Paris	10	1.350	0.33
Amsterdam ↔ Geneva	4	0.688	0.17
Amsterdam ↔ Basel	4	0.620	0.15
Total	93	13.446	3.25
Americas			
Cuzco ↔ Lima	29	5.011	1.21
Lima ↔ Tarapoto	3	0.489	0.12
Cuzco ↔ Puerto Maldonado	3	0.397	0.10
Other routes	2	0.338	0.08
Total	37	6.235	1.51
Asia			
Bangkok ↔ Vientiane	25	3.764	0.91
Other routes	7	1.247	0.30
Bangkok ↔ Chiang Mai	7	1.111	0.27
Total	39	6.122	1.48
Africa			
Lamu ↔ Nairobi	7	1.637	0.40
Other routes	4	0.594	0.14
Total	11	2.231	0.54
Grand Total	**180**	**28.034**	**6.78**

Table 8: Wyss Academy flights and emissions for distances below 700 kilometers.
We grouped routes by continent for easier understanding. Like the arrows show, each route can cut both ways. Routes that were flown less than twice were grouped into "Other routes".

Wyss Academy, although according to the travel policy train should be prioritized as an alternative for these routes. On other continents, switching to rail travel may be a bigger challenge since the two main routes, Cuzco – Lima and Bangkok – Vientiane, cannot be substituted by rail as there are no train options or the journey takes too much time respectively.

The most flown route is between Amsterdam and Zurich. In this case, there is no violation of the travel policy since most train connections take more than 8 hours, even though certain night trains would fall below the threshold of 12 hours. However, night trains might not always be amenable depending on flights schedules.

If we consider routes from Switzerland to other hub airports in Europe such as Frankfurt and Paris, going by train would take less than 8 hours from Bern to either airport. At first glance, flying to these hubs would violate the travel policy. Still, there are some intricacies that need to be addressed.

For Charles-de-Gaulle Airport in Paris, although there are direct train connections between Swiss cities and Paris that take 4-5 hours, employees are required to change trains multiple time in Paris to arrive at Charles-de-Gaulle airport. This reason for flying to Paris was also raised by an employee who considered going by train, but for whom the complexities such as luggage transport, available information, uncertainty with respect to the French railway system, were too big. These issues could be alleviated with better support from management to organize trips through Charles-de-Gaulle airport with, for example, train station pickups in Paris to bring employees to the airport.

For Frankfurt Airport, there are direct train connections from Bern that take 5-6 hours. Hence, compliance with the travel policy would require that this route is travelled by train and flown only exceptionally.

Considering the results in Table 8, we begged the question why Amsterdam seemed to be the hub of choice for travelers from the Wyss Academy since it generates additional emissions which could be avoided by travelling by train to other European hubs. Our first hypothesis was that Amsterdam offers more relevant destinations for the Wyss Academy's activities. We thus considered the destinations from Amsterdam onwards. We see in Figure 8 that Amsterdam mostly connects flights from the South America Hub (Lima) and East Africa Hub (Nairobi) to Switzerland and vice versa. One the one hand, Lima also has direct flights to Paris which is accessible by train from Switzerland. Nevertheless, train travel to Charles-de-Gaulle Airport comes with some aforementioned caveats. However, Nairobi has direct flights to Frankfurt

Airport which can be accessed by train in a few hours. Therefore, the popularity of Amsterdam Airport is not necessarily due to its destination portfolio. Other reasons such as convenience and duration of travel might apply in this case.

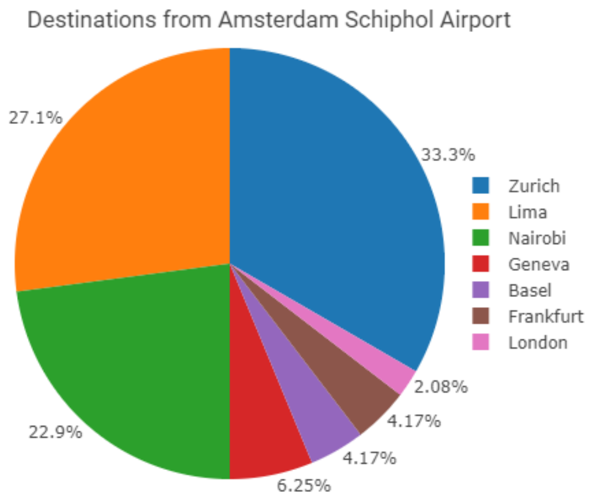

Figure 8: Wyss Academy flight destinations from Amsterdam Schiphol Airport.

To reduce emissions from short-haul flights in Europe, the Wyss Academy could incentivize travelers to use Frankfurt Airport as the default hub for connecting flights, followed by Paris, and only then Amsterdam. This action has the potential to reduce continental flights in Europe and could also simplify booking decisions for employees.

Additionally, the Wyss Academy should consider facilitating the process of booking trains. One reason why employees might choose to fly instead of taking the train is because of the simplicity of the booking platform for flights compared to trains. Indeed, one respondent to our survey mentioned this aspect as the reason why they opted for a plane instead of a train connection from Zurich to Paris. The Wyss Academy could therefore renegotiate its contract with the current booking platform (or explore other providers) to simplify the train booking processes. Some options include providing internal support, integrating train bookings in the same platform as flight bookings, as well as recommending routes and travel plans to its staff.

If the Wyss Academy manages to reduce its continental flights in Europe by 90%, it could reduce total emissions from business travel by approximately 3%. While this may only represent a low emissions reduction, it is also a symbolic step towards embracing the best practices of limiting flying to what is absolutely necessary.

Reduce flights from external stakeholders

Part of the Wyss Academy's GHG emissions originate from external stakeholders that fly on behalf or in collaboration with the Wyss Academy (that includes for instance visits from the Wyss Academy advisory committee and field missions from partners contracted by the Wyss Academy). As such, the Wyss Academy has a responsibility to include them in their reporting as they contribute to the Wyss Academy's work.

Business unit emissions from air travel

	GHG emissions		Flights		Relative to FTE		
Units	*t CO₂e*	*%*	*n*	*%*	*t CO₂e/FTE*	*Flights/FTE*	*FTE*
Internal	*300.761*	*72.77*	*509*	*71.69*	*4.18*	*7.07*	*72.0*
Research and Innovation	181.868	44.00	263	37.04	6.1	8.9	29.6
Hubs South	82.893	20.06	187	26.34	4.7	10.6	17.6
Management Center	26.516	6.42	43	6.06	1.6	2.6	16.5
Policy Outreach and Synthesis	9.484	2.29	16	2.25	2.8	4.7	3.4
Hub Bern	0.000	0.00	0	0.00	0.0	0.0	4.8
External	*112.532*	*27.23*	*201*	*28.31*	*NA*	*NA*	*NA*
Total	**413.293**	**100.00**	**710**	**100.00**	–	–	–

Table 9: Wyss Academy air travel emissions by business unit.
Highlighted values display the highest value in each column. We observe that the Research and Innovation team has the highest number of FTE and tops all other groups in terms of absolute GHG emissions, absolute number of flights, as well as relative GHG emissions per FTE. It is interesting to note that the Hubs South have the highest relative number of flights per FTE. This is because they Hubs South group flies more shorter routes with lower GHG emissions.

As Table 9 shows, external stakeholders represent 27% of total GHG emissions from business air travel which is more than any other business unit at the Wyss Academy except Research and Innovation. The Wyss Academy should therefore carefully consider the mission-relevance of flying external stakeholders. The emission reduction potential in this area is quite significant. Assuming a linear relationship between the number flights and generated GHG emissions for external stakeholders, the reduction of external flights by 50% would represent a reduction of total flight emissions of 13.6% or 56 t CO_2e.

Reduce flights on most popular routes

Table 10 illustrates the Wyss Academy's most flown routes. As the arrows show, the number of flights referenced in the table consider travel in both directions. We see that Lima to Puerto Maldonado and vice-versa is by far the most travelled route over the course of the reporting period. With 170 flights in either direction, this route makes up for almost one quarter of all flights taken within the Wyss Academy and 8.23% of total air travel emissions. To put this into perspective, it means that, on average, every second day an employee or external stakeholder of the Wyss Academy flies this route. Furthermore, the itinerary is flown five times more frequently than the second most flown route. The Puerto Maldonado to Lima route is responsible for approximately the same amount of CO_2e emissions as the Frankfurt to Nairobi route, despite the former being only 850 km in length compared to the latter's 6'300 km.

Most frequented flight routes

	Flights		GHG Emissions	
	n	*%*	*t CO_2e*	*%*
Lima ↔ Puerto Maldonado	170	23.94%	34.032	8.23%
Frankfurt ↔ Nairobi	32	4.51%	33.789	8.18%
Amsterdam ↔ Zurich	31	4.37%	4.991	1.21%
Cuzco ↔ Lima	29	4.08%	5.011	1.21%
Bangkok ↔ Vientiane	25	3.52%	3.764	0.91%
Amsterdam ↔ Lima	24	3.38%	42.320	10.24%
Amsterdam ↔ Nairobi	24	3.38%	25.944	6.28%
Lima ↔ Paris	23	3.24%	44.058	10.66%
Bangkok ↔ Zurich	19	2.68%	28.796	6.97%
Frankfurt ↔ Zurich	19	2.68%	2.295	0.56%
Lima ↔ Madrid	18	2.54%	28.896	6.99%
Madrid ↔ Zurich	14	1.97%	3.430	0.83%
Antananarivo ↔ Nairobi	12	1.69%	4.907	1.19%
Geneva ↔ Paris	12	1.69%	2.025	0.49%
Paris ↔ Zurich	11	1.55%	1.621	0.39%
Iquitos ↔ Lima	10	1.41%	2.150	0.52%
Antananarivo ↔ Paris	8	1.13%	11.432	2.77%
Dubai ↔ Nairobi	8	1.13%	4.808	1.16%
London ↔ Nairobi	8	1.13%	8.864	2.14%
Nairobi ↔ Paris	8	1.13%	10.520	2.55%
Antananarivo ↔ Johannesburg	7	0.99%	2.751	0.67%
Bangkok ↔ Chiang Mai	7	0.99%	1.111	0.27%
Dubai ↔ Geneva	7	0.99%	5.628	1.36%
Lamu ↔ Nairobi	7	0.99%	1.637	0.40%
Bogota ↔ Lima	6	0.85%	2.070	0.50%
Other: 5 flights	15	2.11%	13.410	3.24%
Other: 4 flights	24	3.38%	7.358	1.78%
Other: 3 flights	33	4.65%	19.896	4.81%
Other: 2 flights	54	7.61%	27.392	6.63%
Other: 1 flight	45	6.34%	28.387	6.87%
Total	**710**	**100%**	**413.293**	**100%**

Table 10: Wyss Academy air travel emissions from most flown routes in 2023.

The considerable number of flights undertaken on this itinerary begs the question of whether the Wyss Academy's operations necessitate such a high frequency of travel. While it is challenging to determine what an appropriate frequency would be, the Wyss Academy should cricitcally analyze certain flight routes and assess whether all flights are equally essential.

Figure 9 illustrates the number of Wyss Academy flights arriving at the airports in the vicinity of the regional stewardship hubs. The absolute number represents the total number of times a Wyss Academy employee has landed in the city, whereas the percentage provides a comparison with other arrival cities. It is evident that the South American Hub was the most popular destination in 2023, with 100 flights arriving in Puerto Maldonado. This represents one-seventh of all flights in 2023 and over fifty percent of the flights destined for the hubs. The difference between the number of flights to South America and East Africa is worth investigating, as it may provide insight into the underlaying reasons for this imbalance. There may be strucutural differences in how the hubs are organized and how employees access the facilities that may be addressed. Further investigation is certainly needed but there is definitely a potential to reduce emissions by reducing travel needs to Puerto Maldonado.

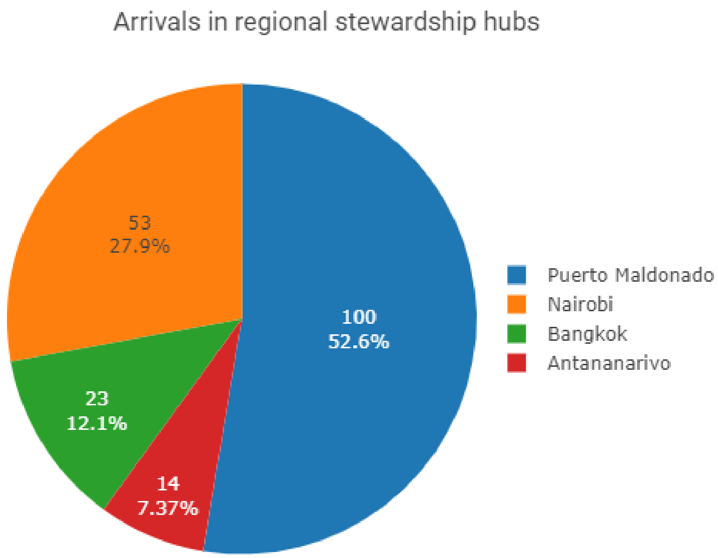

Figure 9: Wyss Academy flight arrivals in stewardship hubs considering.

Employees' perspectives on air travel emissions

We assessed the responses from the anonymous survey amongst Wyss Academy employees to gain insights into their perspectives regarding the necessity to reduce GHG emissions from air travel. When asked about their perception regarding their flight frequency, 80% of respondents felt that they were flying just the right amount. The share of respondents that felt they were flying too much (11%) was about the same as the share that felt that they were flying too little (9%). Furthermore, 72% of respondents believe they could probably not or definitely not achieve their mission if they were required to reduce their flights.

This is in stark contrast to the 69% of respondents who believe that the Wyss Academy should indeed reduce its GHG emissions from air travel. Only one respondent (2%) answered that the Wyss Academy does not need to, while 29% responded that it is not simple. The latter respondents elaborated pointing to the fact that most Wyss Academy employees are conscious about their travel, but that there is a need to work in the contexts of the hubs and have "boots on the ground" to properly achieve their mission.

It becomes apparent that the employees have mixed views. Most agree that the Wyss Academy should reduce its emissions from air travel, but paradoxically most also believe that they would not be able to achieve their missions if air travel was reduced. The environmental consciousness of employees thus clashes with the requirements of their mission.

The survey responses also showed that the Wyss Academy's equal opportunity policy, which partly covers the travel costs of family members, spouses or dependents, does not necessarily affect employees' flying behavior. Five out of the seven respondents who already benefitted from the policy would fly about the same amount if the policy were not in place. The remaining two respondents would fly either more or less often. However, a majority agrees that the policy helps them in achieving their respective missions.

The majority of respondents indicated that the duration of travel was the most significant factor influencing their booking decision, followed by the avoidance layover. In contrast, booking costs and GHG emissions were chosen as the least significant factors. A little over 50% of respondents considered GHG emissions as the third and fourth priority when making a booking decision compared to the others. This result shows that time and convenience have the upper hand on financial and environmental costs when it comes to business travel. However, one respondent pointed out that GHG considerations may not influence a booking decision because these considerations apply beforehand, i.e. when the decision is made to fly or not to fly. While it is true that avoiding air travel has a much greater impact than optimized flight paths, newer aircraft models are oftentimes much more fuel-efficient, especially in the last decade (Zheng & Rutherford, 2020). Therefore, the climate impact of considering GHG emissions when making a booking should not be underestimated. Some flight research engines already provide convenient tools to rapidly compare GHG emissions of different flights options (e.g., Google Flights).

Furthermore, employees were prompted to give inputs about possible solutions to reduce the Wyss Academy's air travel emissions. Given the many responses and many ideas that were shared, we grouped responses by topics. Removing more general responses such as requests to fly less or fly more conscientiously, we arrived at ten groupings and in the following we focus on the five most mentioned topics. Firstly, one third of respondents demanded a more rigorous application of the travel policy, especially with respect to air travel in Europe and minimum stays. While some suggested more consequences in case of infringements to the travel policy, others suggested proactive approach where employees are required to ask for permission and justify air travel before booking. Secondly, close to a quarter of respondents argued for longer trip duration to the regional stewardship hubs to reduce the number of flights. Stays of three to four weeks were suggested, but also the implementation of three months work schemes, where employees stay for at least three months in one location. Thirdly, above 15% of respondents favored the option to increase or shift resources to the Hubs themselves. Improving the research and operational capacity of the Hubs would reduce the number of trips that need to be taken from the Headquarters to the Hubs. Fourthly, twelve percent of respondents mentioned improving the efficiency of trips such that multiple destinations and multiple tasks may be combined in one trip. Moreover, some also mentioned better planning beforehand to avoid having too many employees travelling to the same place for the same event. Fifthly, a few respondents also suggested introducing internal budgets on air travel. The suggestions included setting quotas on teams or individuals, cap-and-trade models, or command and control approaches.

Carbon budget for air travel

2024	2025	2026	2027	2028	2029	2030
5.7 t CO_2e / FTE	5.3 t CO_2e / FTE	5 t CO_2e / FTE	4.6 t CO_2e / FTE	4.2 t CO_2e / FTE	3.8 t CO_2e / FTE	3.4 t CO_2e / FTE

Table 11: Wyss Academy carbon budget for air travel

It may be advisable for the Wyss Academy to implement a carbon budget for its air travel in order to prevent an uncontrolled increase in emissions as its activities expand. The Wyss Academy's organization-wide budget should be based on its emission reduction targets. Given our recommendation to halve Scope 3 emissions by 2030 compared to 2023 (see Figure 5), the Wyss Academy could implement a target budget of approximately 3.4 t CO_2e / FTE for the year 2030 (cf. Table 6). Considering a linear decrease, a reduction of approximately 0.4 t CO_2 per FTE per annum would be appropriate (see Table 11).

Once the budget is fixed, different elements may be applied to enforce this budget within the organization. The following measures may be used jointly or on their own:

1. <u>Quotas</u>

   Fixed quotas could be attributed to the different business units by taking into consideration their needs. The quotas introduce an element of scarcity that provides the impulse for planning flying conscientiously. Hence, allocations should be low enough to incentivize business units to change their behavior towards international air travel.

2. Cap-and-trade

   Providing the system with some flexibility helps reduce the resources needed to uphold the system. If the quota system is implemented on its own, a business unit's remaining emission allowances would have to be reallocated by a centralized unit (e.g., directorate). However, if business units may freely transfer allowances among themselves, it would reduce the administrative load.

3. Auctioning allowances

   Instead of freely allocating quotas, the Wyss Academy could also auction off emissions allowances. Business units would buy emission allowances at a fair carbon price that can be set beforehand. While this measure would render the system somewhat more complex, it would permit the integration of carbon prices directly into the Wyss Academy's operations. However, this would also entail that the financial budget of each business unit is increased to account for the cost of buying emission allowances. One could also imagine that business units may return surplus allowances to increase their budget for research or project implementation.

4. Monitoring

   For an integrated carbon budget model to work, there needs to be a monitoring system in place. The Wyss Academy's travel agency already provides a centralized booking platform. It would be optimal if the booking platform could also monitor the increase of business units' travel emissions in real time.

The integration of a carbon budget into the operations of business units provides a more decentralized approach to emission reductions. This can help to allocate air travel allowances to those teams that need them most since they are best placed to estimate their future needs. It would also be possible to start in a pilot phase by including only a few teams that have relatively high travel requirements. One could even imagine introducing gamification elements to design not only an environmentally sustainable but also attractive process for the teams and employees.

It remains to be seen what should be done if the budget is exhausted before the end of the period (e.g. calendar year). While the Wyss Academy should be strict in order to fulfill their commitment, there will always be exceptions. Nevertheless, the follow through on suggested climate targets will require the Wyss Academy to better control its air travel emissions.

3.3 Addressing Residual Emissions

There is a need to address residual emissions, meaning emissions remaining after reduction options are exhausted. Currently, most organizations turn to compensation of emissions with carbon offsets. However, due to growing criticism of the carbon offset market and uncertainty with respect to the real value of offsets (e.g., Greenfield, 2023), organizations have started to look for other approaches to address residual emissions of their activities.

Two options have gained traction recently. First, organizations have started to overcompensate by purchasing more carbon offsets than actual emissions generated to increase the chance of offsetting their emissions completely. Secondly, organizations have also started moving away from offsetting approaches by adopting climate contribution approaches instead. With this approach, organizations contribute to climate action beyond their value chain without claiming to offset or neutralize any actual emissions (Fearnehough et al., 2023). Instead of purchasing offsets from climate projects at market price, organizations set their own internal carbon fee which they invest at the end of a reporting period. Below, we discuss these approaches in more detail.

3.3.1 Offsetting GHG Emissions

The above options for reducing GHG emissions may have considerable impact on the Wyss Academy's GHG performance. This being said, they will not be sufficient to eliminate GHG emissions completely from the Wyss Academy's value chain, especially in Scope 3 with business air travel, where low carbon alternatives are lacking. While interest in the decarbonization of the aviation sector is growing, novel technologies such as Sustainable Aviation Fuels (SAF), hydrogen or electric planes, are not yet mature enough to achieve the GHG reductions needed (Adler & Martins, 2023; Wang et al., 2024; Viswanathan et al., 2022). For example, even though SAF production sextupled from 100 million liters in 2021 to 600 million liters in 2023, this still represents only 0.2% of global jet fuel use (IATA, 2024). Therefore, the current main path to fly more environmentally conscious is through so-called carbon offsets.

A carbon offset represents either a reduction in CO_2 emissions, or a removal of CO_2 from the atmosphere. The amount of this reduction or removal is designed to be equivalent and compensate for emissions produced in another location or by another activity (van Kooten & de Vries, 2013). The environmental rationale behind the mechanism is that an emission reduction, avoidance, or sequestration has the same impact on cumulative CO_2 emissions regardless of where it is achieved (Ramseur, 2009). Offsetting emissions helps individuals, businesses and governments to compensate for their carbon emissions when direct reductions are not immediately possible or practical. Offsetting emissions can thus be an interim measure for businesses to contribute to climate protection when emission reductions are difficult to achieve; for example, in sectors where low-carbon alternatives are lacking such as air travel.

The suggestion of using market-mechanisms, instead of command-and-control policies, to address the emission of pollutants originated in the 1970s (Chandrasekhar & Goodman, 2023). In 1997, carbon offsets became mainstream with the Kyoto Protocol to the UNFCCC introducing flexible mechanisms such as the Clean Development Mechanism which enabled states to achieve their emission reduction targets partly abroad. States could buy credits equivalent to one ton of CO_2e from emission reduction projects in developing countries.

In parallel, the Voluntary Carbon Market (VCM) has seen considerable growth in the 21st century reaching an all-time high of 516 Mt CO_2e traded credits in 2021 (Procton, 2024). However, in the past two years, growing criticism regarding the quality of carbon credits led to a decline in the volume of traded credits on the VCM. Negative press, in particular regarding large-scale forestry projects, showed that up to 94% of carbon credits for protecting rainforest from deforestation had no benefit to the climate (Fischer & Kurth, 2023; Greenfield, 2023). Falling confidence in the VCM and increased concerns regarding greenwashing led to investment pullbacks and the volume of traded credits fell to 111 Mt CO_2e in 2023 (Procton, 2024).

Criticism vis-à-vis the quality of credits usually stems from the following criteria:

1. Additionality: Did the project result in additional emission reductions that would not have happened anyway?
    a. For example, additional revenue from offsets is unlikely to substantially affect the financial viability of large-scale renewable energy projects (Probst et al., 2023)
2. Permanence: Did the project result in permanent emission reductions or carbon storage or is there a risk of leakage or reversal?
    a. For example, forestry projects have an inherent risk of non-permanence due to forest fires, pests, or human deforestation.
3. Overestimation of impact: Did the project achieve the same volume of emission reductions as estimated?

   a. For example, estimations on emission reductions achieved by cookstove offset projects are often based on laboratory experiments, even though they are highly context-dependent (Probst et al., 2023).
4. Verification: Is it possible to accurately measure and verify the emission reductions of the project?
   a. For example, forestry avoidance, or forest protection, projects rely on satellite data and control groups to estimate emission avoidance from deforestation. These methods have inherent challenges in accurately verifying emission avoidance (Probst et al., 2023)
5. Unintended consequences: Did the project lead to negative consequences on local communities or ecosystems?
   a. For example, some forest protection projects have also led to displacements or violation of indigenous peoples' rights to their land (Dunne & Quiroz, 2023).

Given these valid criticisms, organizations and countries have become more cautious when selecting carbon reduction projects to compensate for their emissions. The Stockholm Environment Institute (SEI) and the Greenhouse Gas Management Institute (GHGMI) have developed a Carbon Offset Guide to select high quality offset and steer off low quality carbon credits (Broekhoff et al., 2019). They identified that quality carbon offset credits must be associated with GHG reductions that are (1) additional, (2) not overestimated, (3) permanent, (4) not claimed by another entity (double counting), and (5) not associated with significant social or environmental harm. However, as we have seen above, these are also the criteria that attract the most criticism because of the difficulty in ensuring them.

According to the SEI and GHGMI, there are a few strategies organizations may use to steer clear off low-quality carbon credits given the difficulty in assessing numerous projects directly. Less reliable methods include "over-buying", also called "discounting", carbon credits in order to hedge against lower quality credits, sticking to carbon credits from lower-risk projects, as well as buying credits from trusted exchanges and retailers such as Gold Standard. In the latter case, the choice is however limited to offset projects offered by the retailer. The most reliable methods to avoid low-quality offsets is to buy credits from projects rated highly by independent rating services and to vet carbon crediting projects directly.

The Wyss Academy should, in our view, use the most reliable methods to ensure that purchased carbon credits are of high quality. To vet carbon projects directly could prove cumbersome for the Wyss Academy due to a lack of publicly available information regarding offset projects and the time and effort associated with selecting and assessing projects. Offset project rating agencies could provide this service for the Wyss Academy. While there is a cost associated to using these services, the Wyss Academy would not need to invest resources – human, financial, and time – to develop rating frameworks and apply them to different offset projects. However, it must be stated that different rating agencies may attach markedly different scores to the same projects due to methodological differences (Faecks & Dufrasne, 2023). Still, if the Wyss Academy wishes to offset their emissions through high quality carbon credits, we recommend relying on individual project ratings conducted by a rigorous and reliable rating service.

Carbon Market Watch commissioned a report that assesses and compares carbon credit rating agencies in this emergent market. Four carbon credit rating agencies are compared: BeZero Carbon, Calyx Global, Sylvera and Renoster. The report concluded that Calyx Global employs the most rigorous methodology overall for both cross-sectoral projects and forestry projects (e.g., REDD+ projects), while still underlining the positive effect all rating agencies can have on the VCM (Wawrzynowicz et al., 2023). However, buyers should still be cautious and engage with rating agencies to better understand the rating process and improve it collaboratively.

While Calyx Global does not publicly share its project ratings, their report on the state of quality in the VCM provides some insight into the type of projects that deliver high or low quality according to their ratings (D. Lee et al., 2024). Figure 10 show that the Manufacturing and Industry sector was found to have the most projects with the highest GHG integrity, while Forest and Land projects had the highest share of projects with the lowest score. Projects in the Waste industry had relatively evenly distributed high- and low-quality ratings, as do Household and Community projects, even though those are little more skewed towards low quality. Finally, renewable electricity projects tend to have low to medium ratings. However, according to their findings, low- and high-quality projects may be found in all sectors and the quality of the carbon credits remains project- and context-specific. Therefore, the selection of projects also depends on a value judgment from the buyer.

The Wyss Academy should consider what transformation they wish to support when purchasing carbon credits. While some types of projects may have lower risk in terms of environmental integrity such as technological projects, other projects may provide greater social and biodiversity benefits such as nature-based projects. It goes however beyond the scope of this thesis to provide a recommendation on one specific project or project-type from which to source carbon credits. This process requires in-depth analysis of a number of projects with high quality scores from rating agencies.

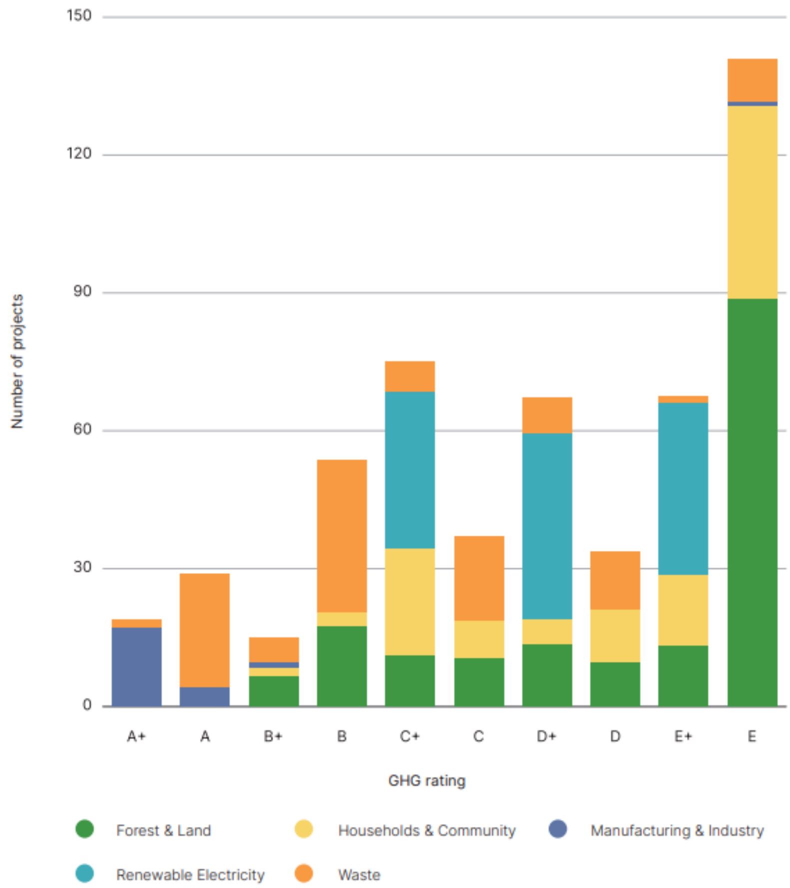

Figure 10: GHG Ratings by Calyx Global, based on number of projects
Source: Lee et al., 2024

Finally, it must be noted that all carbon credits expect those with a perfect score cannot be fully equivalent to an emission reduction of one ton of CO_2e (Faecks & Dufrasne, 2023). Even a carbon credit with a perfect score does not necessarily represent equivalent reduction in the value chain due to methodological differences. As a result, the Wyss Academy should not consider offsets as a mechanism that fully compensates for their value chain emissions, especially not claim that it does. Instead, carbon offsets should be seen as a tool to contribute to climate change mitigation and the Wyss Academy should use ratings to better understand strengths and weaknesses of certain projects (Faecks & Dufrasne, 2023).

3.3.2 Climate Contribution Model

The climate contribution model differentiates itself from the GHG offsetting model primarily in the organization's approach and position it takes toward climate action. The main objective of climate contributions is not to *offset* generated emissions by simply purchasing carbon credits, but to *contribute* to climate change mitigation in the full knowledge that it does not compensate generated emissions. The New Climate Institute defines climate contributions as "finance provided by an organization to support climate action beyond its own value chain, without claiming to offset, or neutralize, any actual emissions. They represent a financial commitment that is a complement – and in no way an alternative – to directly reducing one's own climate footprint" (Fearnehough et al., 2023, p. 12). This does not preclude a climate contribution model from purchasing carbon credits as part of its strategy, but the financial contribution should be based on a pre-defined price for each ton of CO_2e emitted, rather than the carbon credit price set by the market.

Claiming a contribution to climate mitigation, rather than a compensation for generated emissions, has several advantages for organizations. First, it protects organizations from criticism since focusing on high-quality carbon credits still rarely equates to real emission reductions of one ton of CO_2e. Second, organizations are not limited to the VCM to contribute to climate action and can invest in transformative system change in other areas. Third, climate contributions enable a transparent framework of an organization's climate ambition since the financial contribution is not responsive to the market prices of carbon credits, but the volume of funding is directly linked to the volume of an organization's carbon footprint (Fearnehough et al., 2023).

One important drawback to the contribution model is the quantification of the climate impact. In contrast to offsetting, where methodological standards quantify how much CO_2 a project managed to reduce or remove from the atmosphere, the impact of climate contributions is vaguer. As a result, it may be more difficult to present the climate impact of an organization's contributions. Nevertheless, given the shortcomings in quantifying the climate value of offsets discussed in Chapter 3.3.1, the climate contribution model should anyway not attempt to claim to neutralize operational GHG emissions.

Raising the Funds

To adopt a climate contribution approach, the New Climate Institute recommends introducing a carbon fee on all activities as the main instrument for raising funds (Fearnehough et al., 2023). The fee should cover an organization's activities throughout the value chain, including emission scopes. The carbon fee enables a company to internalize these costs over the course of their activities. Furthermore, it creates an incentive for the organization to reduce emissions wherever it is cheaper than "paying" the carbon fee. As a result, the carbon fee should be set at a level that incentivizes value chain emissions reductions.

The New Climate Institute recommends a price level of USD 100-250 (Fearnehough et al., 2023) per t CO_2e emitted with a clear plan to raise the price over time. Their recommendation is in line with estimates for the social cost of carbon as well as CO_2 prices to fully decarbonize the economy by mid-century (e.g., Bertram et al., 2021; Bouckaert et al., 2021). It holds that the higher the fee, the more ambitious the climate commitment of the organization. For the Wyss Academy, a carbon fee of USD 100-250 would translate into a climate contribution fund of approximately USD 44'000-110'000 in 2023, with 94% of these costs being the result of business travel (see Figure 3). Figure 11 provides an overview of the volume of climate contributions by scope and category if the Wyss Academy were to implement a carbon fee of, for example, CHF 150 per t CO_2e on all tracked emissions. As expected, the share of climate contributions due to business travel is the highest with 62'070 CHF in 2023. The remaining emissions amount to a climate contribution of around 4'000 CHF.

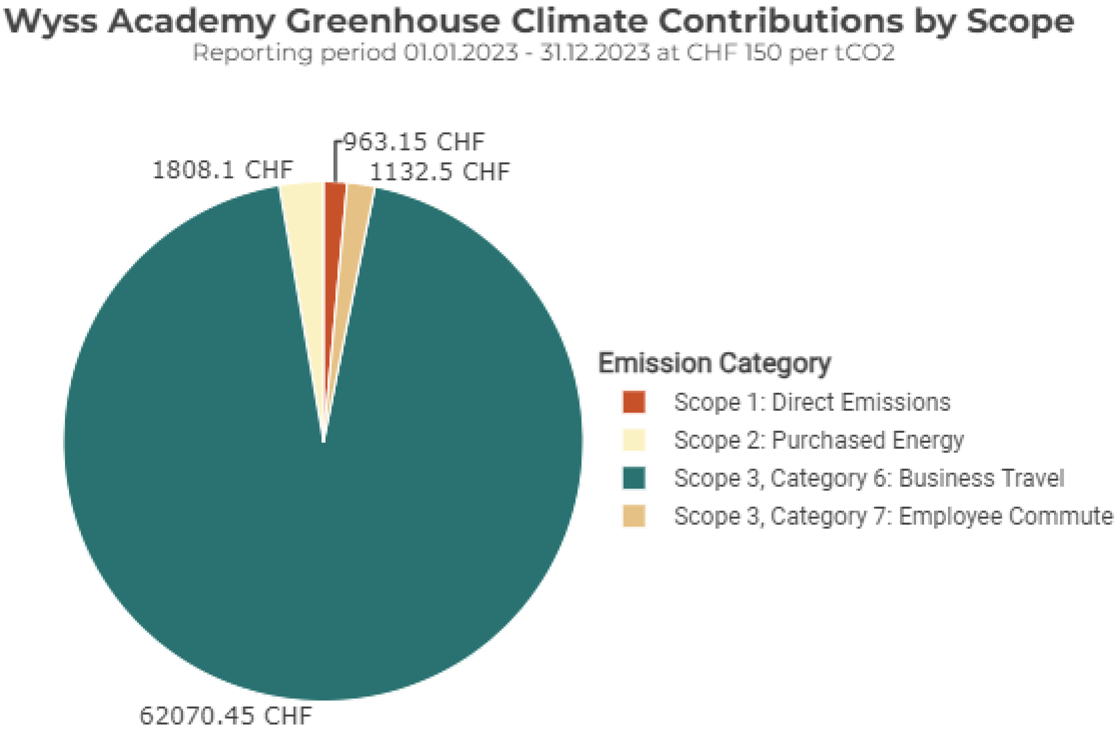

Figure 11: Wyss Academy potential climate contributions in 2023.

Identifying the appropriate carbon price level will require gauging the Wyss Academy's economic possibilities and climate ambition. From an ambition perspective, the carbon price level should be at least 100 CHF per t CO_2e and as high as financial means allow. The Wyss Academy's climate contribution fund should also increase over time as more emission sources are tracked and included in their GHG inventory. Furthermore, as value chain emission reductions become more expensive, the carbon fee should steadily increase too to avoid an economic incentive to generate emissions and pay the fee. In other words, the Wyss Academy should reassess periodically whether its carbon fee is still in line with the recommendations of policymakers and experts in the field.

Spending the Funds

Once the funds are raised, it is crucial that they are spent effectively to advance climate action. The New Climate Institute (Fearnehough et al., 2023) recommends that the spending focus of the funds should be on transformative system change and climate action beyond the value chain. It should unambiguously target truly inaccessible climate finance.

The great advantage of the climate contribution approach is that the investment areas are much broader. Since the goal of the contribution is not necessarily to offset emissions, organizations can financially contribute to a range of activities that may be difficult to quantify in terms of emissions reduced or some riskier technologies that are yet unable to successfully deliver at scale. Some options outside carbon markets include:

1. Research and Development
2. Protecting and restoring the natural environment
3. Advocacy and awareness campaigns
4. Encouraging behavior change
5. Channeling contributions to hard-to-reach projects in developing countries
6. Identify and support nascent technologies

Day et al. (2023) authored a report published by the New Climate Institute which focus on the high hanging fruits of mitigation, such as technologies and measures that remain inaccessible to host country governments in the near to medium term, due to the high costs involved or other significant barriers to implementation. The report provides a few examples such as building heat in Mongolia, the electrification of transport in Indonesia, and agriculture in Georgia. The Wyss Academy's challenge is to identify its own high hanging fruits towards which to invest their climate contributions.

4 DISCUSSION AND CONCLUSION

This first attempt to build a GHG inventory of the Wyss Academy records the main sources of emissions resulting from the organization's activities. However, there are still emission sources that are not included due to missing activity data and a lack of monitoring systems. These shortcomings need to be addressed for future reporting periods.

During our analysis we identified several areas of improvement for the Wyss Academy's GHG inventory. Firstly, the Wyss Academy should implement systems to monitor energy use in the regional stewardship hubs. Since the Wyss Academy's scope 2 emissions are more relevant to its activities than scope 1 emissions, it is crucial that emissions from the purchase of energy are accounted for and reported completely.

Secondly, the Wyss Academy's approach to addressing wicked problems across the world relies on bringing people together. As a result, business travel is an essential part of the Wyss Academy's activities. While the Wyss Academy's monitors rail travel in Switzerland and air travel centrally, it does not monitor emissions from road travel, even though it purchases transportation services from third parties such as professional drivers, taxis, and other road travel services. Therefore, a system that monitors distances travelled or quantities of fuel used should be operationalized. Furthermore, the Wyss Academy should qauntify rail travel in the regional stewardship hubs as well as hotel stays in the business travel category.

Thirdly, monitoring and reporting other scope 3 categories should be considered. We identified several categories to which reporting could be extended. Among others, the Wyss Academy could start estimating emissions from the purchase of goods such as paper, food, coffee, electronics, and services such as the use of high-performance computing for running research models. Although we examined the latter category, we were unable to obtain readily available data except for the fact that the high-level computing center used by the Wyss Academy is fully powered by hydropower energy (Ulmer, 2022). Furthermore, once energy consumption data is available for regional stewardship hubs, the Wyss Academy should consider reporting upstream and downstream emissions of purchased energy under scope 3, category 3.

Nevertheless, the emission sources identified in this thesis are expected to represent the bulk of the Wyss Academy's GHG emissions. The preeminence of air travel emissions is unlikely to change even with the addition of further emission sources in the GHG inventory. Hence, the Wyss Academy's primary focus should lie on operationalizing methods to optimize and lower air travel.

The goals of this thesis were twofold. On the one hand, we quantified the overall GHG footprint of the Wyss Academy. We determined that flight emissions contribute to the majority of the foundation's GHG emissions representing approximately 94% of total GHG emissions. In comparison direct emissions from owned assets and indirect emissions from energy consumption only represent a small percentage of total emissions.

On the other hand, we discussed options to align the Wyss Academy with the targets of the Paris Agreement. We determined that a first step towards alignment is to set a reduction target to halve GHG emissions by 2030 in all scopes based on 2023 emissions. Given the growth trajectory of the Wyss Academy, this is an ambitious target. Therefore, we suggested that the reduction target is not based on absolute GHG emissions, but relative to FTE. This leaves room for the Wyss Academy to grow its operations and staff with an objective that remains ambitious but also realistic.

Furthermore, we discussed different options to reduce flight emissions without compromising the Wyss Academy's mission. We saw that short-haul flights remain popular, even though the travel policy prohibits them. While the GHG reduction potential of substituting short-haul flights in Europe is meagre relative to total flight emissions, the Wyss Academy should consider all possibilities to reduce flights and embrace best practices wherever possible. We also discussed the prevalence of external stakeholders, generating more than a quarter of all flight emissions. Additionally, the Wyss Academy should carefully assess why some flight routes are employed to such a high frequency and whether there are options to reduce the travel needs to these popular destinations. Finally, the optimization of flight patterns within the Wyss Academy will only reduce GHG emissions to a certain degree. In the end, the implementation of a carbon budget to reduce flying within the Wyss Academy altogether is a necessary step to achieve a GHG reduction target.

Finally, given the Wyss Academy's mission, flying will remain a necessary aspect of its operations. To address the climate impacts of these GHG emissions, we determined that the most environmentally responsible option is the climate contribution approach. We arrive at this conclusion as a result of a confidence crisis in the true value of carbon credits issued from offsetting projects. In addition, climate contributions do not claim to quantitatively compensate emissions even if offsetting projects may be a part of this approach. Instead, climate compensation integrates a carbon price into its operations that it reinvests in a climate positive manner. We are confident that this approach is more environmentally responsible and respected by internal and external stakeholders.

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APPENDIX A: QUALITY CRITERIA FOR MARKET-BASED APPROACH

1. Contractual instrument conveys the direct GHG emission rate attribute associated with the unit of electricity produced?

   Yes. HKNs convey the direct CO_2 emission rate associated with the unit of electricity produced (HKSV, 2017, Article 1.2). However, disclosure of other GHG emission rates, such as methane and nitrous oxide emission rates, are not required by law and not included in HKNs.
2. Only instrument that carries the GHG emission rate claim associated with that quantity of energy generation?

   Yes. Each HKN uniquely carries the GHG emission rate claim associated with a quantity of energy generation. The sum of energy generated in all HKN corresponds to the sum of energy produced in Switzerland.
3. Instrument is tracked and redeemed, retired, or cancelled by or on behalf of the reporting entity?

   Yes. HKNs are tracked in a national registry and cancelled by the energy supplier. The electricity supplier is required to report its production mix on the basis of cancelled HKNs.
4. Instrument issued and redeemed as close as possible to the period of energy consumption to which the instrument is applied?

   Yes. If not cancelled, an HKN loses its validity after twelve months and cannot be redeemed (HKSV, 2017, Article 1.4).
5. Instrument sourced from the same market in which the reporting entity's electricity-consuming operations are located and to which the instrument is applied?

   Yes. The Wyss Academy does not hold any energy certificates from other markets.
6. Utility-specific factors shall be calculated based on delivered electricity, incorporating certificates sourced and retired on behalf of its customers.

   Yes. The Swiss HKN system ensure that utility-specific emissions are based on delivered electricity, i.e. cancelled HKNs.
7. An adjusted, residual mix characterizing the GHG intensity of unclaimed or publicly shared electricity shall be made available for consumer scope 2 calculations, or its absence shall be disclosed by the reporting entity.

   Not applicable to Switzerland. The HKN system has enabled Switzerland to join a select list of countries with full disclosure of electricity. As such it does not have a residual mix. In other words, all energy generation is accounted for by HKNs (AIB, 2023).

APPENDIX B: DETAILED ELECTRICITY EMISSIONS

Market-based method GHG emissions

To calculate Scope 2 electricity emissions, we analyzed the emission sources of the electricity product purchased by the Wyss Academy. In Table 12, the column instrument represents the type of instrument used for purchasing electricity. HKN means "Herkunftsnachweise" translated to Guarantees of Origin (GoO). All electricity purchases and instruments are compliant with the Scope 2 Quality Criteria of the GHG Protocol. The CO_2 emission factors and CO_2e emissions only consider fossil CO_2 emitted during electricity generation. Emission factors for CH_4 and N_2O are from (FOEN, 2023b). CH_4 emissions from MSW incineration are not significant due to the high temperature of incineration. Non-CO_2 emissions were converted to CO_2e with GWP-100 values from IPCC (2021).

Scope 2 electricity emissions for market-based method

Reporting period 01.01.2022 - 31.12.2022

	Activity			Emission factors			Emissions
Energy Source	Quantity MWh	Instrument Certificate	Compliance Quality criteria	CO_2 g/MWh	CH_4 g/MWh	N_2O g/MWh	CO_2e kg
Hydropower	17.474	HKN (GoO)	✓	0	0	0	0.000
Solar	2.184	HKN (GoO)	✓	0	0	0	0.000
Biomass	1.092	HKN (GoO)	✓	0	1.44	14.40	4.336
MSW Biogenic	1.092	HKN (GoO)	✓	0	NS	4.07	1.213
Total	**21.842**						**5.549**

Table 12: Wyss Academy electricity and emissions in 2022 (market-based).

Location-based method GHG emissions

Organizations reporting scope 2 emissions with the market-based method must also report their scope 2 emissions with the location-based method. According to the GHG Protocol, the grid average emission factor should represent all the emissions from energy generation occurring within a defined geographic region, and thereby best represent the purpose of the location-based method (GHG Protocol, 2015, p. 53). In other words, only GHG emissions at the point of electricity generation produced within a set geographical boundary should be considered.

For our calculation, we used national average grid emission factors from the Association of Issuing Bodies. The AIB compiles the residual, supplier and production mix of European countries' national electricity grids every year. Switzerland has one of the lowest average grid emission factors in Europe. In fact, only Iceland shows a lower average production mix due to its large supply of hydroelectric and geothermal energy.

Scope 2 electricity emissions for location-based method

Reporting period 01.01.2022 - 31.12.2023

	Activity	Emission factors				Emissions
Office	Quantity MWh	CO_2 g/MWh	CH_4 g/MWh	N_2O g/MWh	Source Emission factors	CO_2e kg
Switzerland	21.842	2'550*	*	*	AIB Switzerland, 2022	55.697
Total	**21.842**					**55.697**

* Non-CO_2 emission factors are not evaluated by the Association of Issuing Bodies (AIB).

Table 13: Wyss Academy electricity and emissions in 2022 (location-based).

AIB estimated the average CO_2 emissions factor of the Swiss production mix at 2.55 g CO_2 per kWh (AIB, 2023). It should be noted that the AIB does not evaluate non-CO_2 emission factors. As a result, CO_2 equivalent emissions are certainly higher in practice. For reference, the total supplier mix, i.e. including electricity imports, were estimated at 2.75 g CO_2 per kWh.

Comparing Table 12 and Table 13 we see that, for the market-based method, the Wyss Academy's office in Bern emitted 5.5 kg CO_2e, whereas for the location-based method, emissions are estimated at 55.7 kg CO_2e in 2022. We observe that GHG emissions reported with the market-based method are ten times lower than the ones with the location-based method. This being said, the average CO_2 intensity of the Swiss grid is so low that the absolute emissions savings of 50 kg CO_2e is not very significant. 50 kg CO_2e are equivalent to 286 kilometers, or approximately a one-way trip between Zurich and Geneva in an average Swiss passenger vehicle (FOEN, 2023a).

Still, we can determine that the Wyss Academy makes sound market choices for its electricity consumption in the Bern office. It could also be stated that the choice of setting their Headquarters in Bern proved a climate smart decision compared to other places around the world. Indeed, in the United States, an average home's yearly GHG emissions from electricity consumption are estimated at 5 t CO_2e (US EPA, 2024). Hence, one thousand times higher than the Wyss Academy's GHG emissions from electricity consumption.

APPENDIX C: DETAILED HEATING EMISSIONS

Energy consumption and GHG emissions from heating for the market-based method are presented in Table 14**.** Total energy consumption was attributed to energy sources based on their share in the product mix. It is important to note that CO_2 and CO_2e emissions presented in Table 14 do not include biogenic CO_2 emissions, i.e. CO_2 emissions from biogenic sources such as biomass or biogenic waste. However, CO_2 emission factors presented consider those biogenic emissions. The last row provides sums of energy consumption and GHG emissions as well as averages in brackets.

Scope 2 heating emissions for market-based method

Reporting period 01.05.2021 - 30.04.2022

Activity Data		Emission factors				GHG Emissions			
Energy Source	Quantity MWh	CO_2 kg/MWh	CH_4 g/MWh	N_2O g/MWh	Fossil CO_2 %	Fossil CO_2 t	CH_4 kg	N_2O kg	**CO_2e t**
MSW	58.97	331.2	NS	4.1	47.8	9.34	NS	0.24	**9.40**
Biomass	39.97	359.6	1.44	14.4	0.0	0.00	0.06	0.58	**0.16**
Natural Gas	18.29	201.2	3.60	0.4	100.0	3.68	0.07	0.01	**3.68**
Total (avg)	**117.23**	(320.6)	(1.05)	(7.01)	(34.63)	13.02	0.12	0.82	**13.24**

Table 14: Wyss Academy heating and emissions in 2022 (market-based).

We observe that the majority of GHG emissions occur from the incineration of MSW. Indeed, 9.4 t CO_2e or approximately seventy percent of total GHG emissions from purchased heat is attributed to MSW. This share would be even higher if we included biogenic CO_2 emissions. The remaining GHG emissions are mostly from natural gas while the incineration of biomass produces as little as one percent of total CO_2e emissions due to some methane and nitrous oxide emissions.

It is interesting to note that the average share of fossil CO_2 of the district heating product is quite high. Close to 35% of total generated CO_2 is fossil compared to 0% in the electricity consumption. Since the share of fossil waste in MSW is approximately 50% and the quantity of energy from MSW generated in the product mix is also approximately 50%, the share of fossil CO_2 will be at least 25%. The only possibility of reducing the share of fossil CO_2 emitted would be to reduce the quantity of MSW in the product mix. We discuss reduction options in more detail in Chapter 3.2.2.

APPENDIX D: BIOGENIC CO_2 EMISSIONS

In Table 15, we observe that biomass produces 14.77 tons of biogenic CO_2 emissions. These biogenic emissions including those from the biogenic share of MSW add up to 25.33 tons of CO_2. In fact, biogenic CO_2 emissions are more than ten tons higher than fossil CO_2 emissions. Even if biogenic emissions are considered CO_2 neutral, they return a considerable amount of CO_2 to the atmosphere which might have been stored for longer, especially in the case of biomass. Emission factors were obtained from Switzerland's National Inventory Document (FOEN, 2023b)

Scope 2 biogenic emissions Switzerland

Reporting period 01.05.2021 - 30.04.2022 (heating) & 01.01.2022 - 31.12.2022 (electricity)

Activity Data		Emission factors		GHG Emissions	
Energy Source	Quantity MWh	CO_2 kg/MWh	Fossil CO_2 %	CO_2 t_{fossil}	**CO_2 t_{bio}**
Electricity					
Hydro	17.47	0.0	0.0	0.00	**0.00**
Solar	2.18	0.0	0.0	0.00	**0.00**
Biomass	1.09	359.6	0.0	0.00	**0.39**
Waste Biogenic	1.09	331.2	0.0	0.00	**0.36**
Heating					
MSW	58.97	331.2	47.8	9.34	**10.19**
Biomass	39.97	359.6	0.0	0.00	**14.38**
Natural Gas	18.29	201.2	100.0	3.68	**0.00**
Total (avg)	**139.07**	(275.69)	(33.95)	13.02	**25.33**

Table 15: Wyss Academy estimated biogenic CO_2 emissions in 2022.

APPENDIX E: DETAILED EMISSIONS FROM RAIL TRAVEL

Table 16 shows the Wyss Academy's GHG emissions from rail travel. We can see that rail travel in Switzerland accounts for the vast majority of journeys, with 96% of journeys made within Swiss borders. Although cross-border journeys tend to be longer, the sheer number of journeys made within Switzerland means that the majority of the distance travelled by train is still within Swiss borders, at around 80%. However, due to the very low emission intensity of the Swiss railways, the 18 international trips made during the reporting period account for almost half of all GHG emissions from rail travel. Still, rail travel accounts for only 0.5 t CO_2e in total. In relative terms, this corresponds to about 10.8 g CO_2e per km, compared to 169.8 g CO_2e for an average Swiss passenger car (FOEN, 2023a).

Scope 3, Category 6, Subcategory Rail Travel
Reporting period 01.01.2023 - 29.11.2023

	Trips		Distance		Emissions	
	%	n	%	km	%	kg CO_2e
Switzerland	96.03	435	81.16	38'261	52.61	267.83
Below 30 km	22.52	102	1.72	810	1.11	5.67
Above 30 km	73.51	333	79.45	37'451	51.50	262.16
Europe	3.97	18	18.84	8'879	47.39	241.23
Germany	2.21	10	11.86	5'593	36.70	186.81
France	1.55	7	6.37	3'005	7.38	37.56
Italy	0.22	1	0.60	281	3.31	16.86
Total	**100.00**	**453**	**100.00**	**47'140**	**100.00**	**509.06**

Table 16: Wyss Academy rail travel GHG emissions

APPENDIX F: QUESTIONNAIRE GHG EMISSIONS HUBS

1. Which redgional stewarbship hub are you filling out this survey for?

   ☐ South America

   ☐ East Africa

   ☐ South East Asia

2. Are the team members contracted by the Wyss Academy or the host organization?

   ☐ Wyss Academy

   ☐ Host Organization

3. Who contractually own or leases office spaces

   ☐ Wyss Academy

   ☐ Host Organization

4. Does the hub already have a system in place to monitor greenhouse gas emissions, i.e. a greenhouse gas inventory of its own?

   ☐ Yes

   ☐ No

5. If a GHG inventory for 2023 has already been prepared, or is set to be completed before 29 February 2024, please send the documents to fabio.petrig@students.unibe.ch. Thank you!

   ☐ Yes, a GHG inventory for 2023 is being prepared and will be sent to you.

   ☐ No, a GHG inventory for 2023 is not yet being prepared or will not be completed before the deadline.

6. Does the hub own or lease any cars?

   ☐ Yes

   ☐ No

7. Do you monitor the fuel use of these cars?

   ☐ Yes

   ☐ No

8. Please enter the type of fuel and the number of liters of fuel used in 2023. For example:

   - Gasoline: 500 liters
   - Diesel: 200 Liters

9. Do you monitor the number of kilometers driven?

   ☐ Yes

   ☐ No

10. Please enter the model of the car, the model year, the fuel used, and the number of kilometers driven in 2023.

    For example:

    - Toyota Prius - 2017 - Gasoline - 2300
    - Honda Civic - 2015 - Diesel - 1200

    If the kilometers **by car** are not available, please try to provide an estimate by car. If that is not possible, please provide the total kilometers driven for all cars on a new line (e.g., "Total: ...")

11. Please enter the model of the car, the model year, and the fuel used. For example:

    - Toyota Prius - 2017 - Gasoline
    - Honda Civic - 2015 - Diesel

    If possible, please try to provide an estimate of total kilometers driven in 2023 on a new line (e.g., "Total: ...")

12. Are there other means of transportation that the team relies on to travel locally?

    ☐ No

    ☐ Contracted transportation services

    ☐ Taxi, Uber, Lyft, etc.

    ☐ Short-term car rentals

    ☐ Other:

13. If you have access to any information relevant to calculating GHG emissions from these alternative means of transport, please specify here.

    Relevant information can be:

    - Type of car: passenger car, bus, minivan, truck...
    - Kilometers/Miles driven
    - Type and amount of fuel consumed

14. Do you have access to documents detailing the energy use for **heating** the office (e.g., energy bills)?

    <u>Necessary information:</u>

    - Type of fuel

- Quantity of fuel
- Timeframe of consumption

15. Please send the documents showing the energy use for heating to fabio.petrig@students.unibe.ch.

    ☐ Yes, done!

    ☐ No, estimate emissions (continue survey)

16. Approximately, how many square meters of office space do you have?
17. How are office spaces heated?

    ☐ Not heated

    ☐Purchased fossil fuels that are burned in-house (e.g., boiler, furnace)

    ☐ Purchased heat (e.g., district heating)

    ☐ Heat pumps

    ☐ Electric heating

    ☐ Other:

18. Please specify the fuel source (e.g. fuel oil, natural gas...)
19. If available, please indicate the amount of fuel or energy used in 2023 for heating. Please also indicate the units (tons, kg, liters, kWh...).

    Please also indicate the timeframe of energy consumption, in particular, when the data does not cover the full year. For example:

    - 2'000 liters (01.09.2022 - 31.08.2023)

20. Do you have access to documents detailing the **electricity** use of the office (e.g., electricity bills)?

    <u>Necessary information:</u>

    - Source of electricity (type of power plant)
    - Amount of electricity (e.g. kWh)
    - Timeframe of consumption

    ☐ Yes

    ☐ No

21. Please send the documents showing the office electricity use to fabio.petrig@students.unibe.ch.

    ☐ Yes, done!

☐ No estimate emissions (continue survey)

22. How are office spaces powered (electricity)

☐ Regional power plant

☐ Off-grid renewable energy

☐ Other:

23. Type of power plant?

☐ Coal power plant

☐ Diesel power plant

☐ Gas-turbine power plant

☐ Nuclear power plant

☐ Hydropower plant

☐ Renewable power plant

☐ Other:

24. Please specify the fuel or energy source of the power plant (e.g., solar, wind, etc.)
25. If available, please indicate the amount of electricity consumed in 2023. If possible, please indicate in kWh.

    Please also indicate the timeframe of electricity consumption, in particular, when the data does not cover the full year. For example:

    - 6500 kWh (01.09.2022 - 31.08.2023)
26. Is the office cooled an air-conditioning system?

☐ Yes

☐ No

27. Can you think of any other relevant GHG emissions regarding Wyss Academy activities in the host country?

APPENDIX G: QUESTIONNAIRE EMPLOYEE COMMUTING

1. What is your place of work at the Wyss Academy?

   ☐ HQ

   ☐ Hub South America

   ☐ Hub Southeast Asia

   ☐ Hub East Africa
2. Approximate number of kilometers from your home to your office in 2023?
3. How many times per (working) week do you go from your home to the office on average in 2023?
4. What is your main form of travel to go to the office?

   ☐ Car

   ☐ Train

   ☐ Bus

   ☐ Plane

   ☐ Bicycle, walk

   ☐ Other:
5. Please provide
   - The model of the car (e.g., Ford Fiesta) or the build of the car (e.g., SUV, Sedan, sports car…)
   - The model year, and
   - The fuel type (e.g., gasoline, diesel…)
6. What route do you usually fly (airport to airport)

APPENDIX H: QUESTIONNAIRE EMPLOYEE AIR TRAVEL

1. Have you ever flown as part of your work for the Wyss Academy?

   ☐ Yes

   ☐ No

2. Approximately how many work-related flights did you take in 2023?
3. Did you fly within Europe in 2023?

   ☐ Yes

   ☐ No

4. Did you consider going by train instead of flying

   ☐ Yes

   ☐ No

5. What were your motivations to take a flight instead of taking the train?
6. Do you feel like you are flying ….

   ☐ too much

   ☐ about the right amount

   ☐ too little

7. Do you think you could reduce your flights and still achieve your missions?

   ☐ Definitely

   ☐ Probably

   ☐ Not sure

   ☐ Probably not

   ☐ Definitely not

8. Is there something the Wyss Academy can do to help you reduce the number of flights you take per year?
9. Do you consider the Wyss Academy's travel policy every time before booking a flight?

   ☐ Yes

   ☐ No

10. Do you think the Wyss Academy's travel policy is easily understandable?

    ☐ Yes, everything is clear

    ☐ No, some parts are not very clear

11. Which parts of the travel policy do you not find clear?
12. Have you already benefitted from the Wyss Academy's equal opportunity policy that partly covers the travel costs of your accompanying family members, spouses, or dependents?

    ☐ Yes

    ☐ No
13. Would you fly less if the equal opportunity policy would not exist?

    ☐ Yes, I would fly less often

    ☐ No, I would fly about the same amount

    ☐ No, I would fly more often
14. Does this policy help you in achieving your mission?

    ☐ Definitely

    ☐ Probably

    ☐ Probably not

    ☐ Definitely not
15. Please order the following reasons from most important to least important when you make a booking decision for work-related flights:

    ☐ Duration of travel

    ☐ Costs

    ☐ Avoid layovers

    ☐ Greenhouse gas emissions
16. Are there other reasons that are important to you when you make your booking decision?
17. In general, do you think the Wyss Academy should reduce its GHG emissions from air travel?

    ☐ Yes

    ☐ No

    ☐ It's not so simple
18. Can you elaborate?
19. Do you have any comments, inputs, or ideas, on how the Wyss Academy could reduce its greenhouse gas emissions from air travel?

Declaration of consent

on the basis of Article 30 of the RSL Phil.-nat. 18

Name/First Name: Petrig Fabio

Registration Number: 17-614-256

Study program: MSc Climate Sciences

Bachelor ☐ Master ☑ Dissertation ☐

Title of the thesis: Counting carbon: Reducing the Climate Impact of the Wyss Academy's Operational Emission Sources

Supervisor: Prof. Dr. Edouard Davin

I declare herewith that this thesis is my own work and that I have not used any sources other than those stated. I have indicated the adoption of quotations as well as thoughts taken from other authors as such in the thesis. I am aware that the Senate pursuant to Article 36 paragraph 1 litera r of the University Act of 5 September, 1996 is authorized to revoke the title awarded on the basis of this thesis.

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