

South East European University

Climate Action Plan

May 2011



Teaching a Sustainable Future



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1 INTRODUCTION



Within the last few years, following the high level commitments on climate change, several university campuses have started planning to reduce their net emissions, in order to manage carbon and energy more efficiently.

The South East European University (SEEU) of Tetovo, Macedonia, located about 40 km from the capital Skopje and 484 m above the sea level, covers an area of about 200,000 m² and hosts approximately 6,000 students.

The Campus has started the path to sustainability few years ago, with the aim to manage carbon and energy more efficiently. The realization of a Climate Action Plan (CAP) constitutes a roadmap to get Universities to the goals of climate protection, defining a carbon footprint, identifying priority actions, milestones to measure progress and target dates, raising funding opportunities. The methodological approach for the realization of a Low Emission Campus through the implementation of a CAP at SEEU foresees the analysis of the current energy consumptions and greenhouse gases (GHG) emissions and the integrated planning for the implementation of carbon-friendly measures.

1.1 THE CLIMATE ACTION PLAN (CAP)

Following the realization of a Greenhouse Gas Inventory, the CAP represents a powerful tool to reduce SEEU's carbon footprint, aimed at delineating strategies and a timeline for reducing greenhouse gas emissions. Furthermore, it allows pursuing the goals of integrating sustainability and climate action in all aspects of teaching, research, and community outreach.

Universities can provide both practical and moral leadership with regards to society's efforts to address climate change by taking steps to reduce their own emissions.

The SEEU CAP is a 10-year strategic plan for how the campus will undertake the path to carbon neutrality.

Given technological change, the global economy facts and the Campus growth ambitions over the coming decades, the CAP is conceived as a living document, to be regularly updated to reflect the state-of-the-art, as well as the state of the Campus.

Each institution should conduct an inventory of its greenhouse gas emissions to determine the baseline from which progress will be measured. In July 2010, the University released its first inventory of campus greenhouse gas emissions. The report, entitled "Greenhouse Gas Emissions at SEEU Campus, 2005-2009" was prepared by a dedicated Technical Working Group created in March 2010 to address the sustainability topics. SEEU's first Greenhouse Gas Inventory was completed in July 2010. This first Climate Action Plan, identifying greenhouse gas



emission reduction strategies, was drafted as a community effort through public involvement, input from the Technical Working Group, and oversight by the Campus Board.

This CAP includes:

Section 2 – Methodological Approach:

Section 3 – Greenhouse gas emissions (GHG) inventory:

- describes SEEU campus emissions, outlining the inventoried emissions and projecting future emissions growth;

Section 4 – GHG Reduction Strategies:

- identifies and assesses a number of mitigation actions in renewable energy, buildings, transportation, and policies;
- summarizes the expected benefits and evaluates the potential impact of the initiatives, Scope by Scope, in comparison to SEEU's emissions trend;

Section 5 – Project Evaluation and Ranking:

- describes the selected approach for implementation;
- presents interim results and investments;

Section 6 – Role of Education and Research:

- discusses opportunities to promote cultural change and raise SEEU as a regional climate leader;
- outlines an approach to integrating sustainability into education and research;
- strategizes ideas to engage the community, improve communications and outreach, and to promote behavioral change;

Section 7 – Implementing this plan: CAP Financing:

- delineates responsibility for implementing change to achieve climate neutrality by identifying key campus actors;
- shows possible barriers to actual CAP implementation;
- explores the potential mechanisms of financing that SEEU can leverage to achieve climate neutrality;

Section 8 – Tracking Progress:

- discusses the future steps for recording the achieved sustainable results;

Section 9 – Conclusions.

1.2 INSTITUTIONAL STRUCTURE

1.2.1 SEEU Overview

SEEU is now in its ninth year of operation with more than 6,000 students and 3,000 graduates. From opening its campus in Tetovo in October 2001, it has succeeded in establishing itself as a quality-led, financially sustainable university, now regarded as a model for multi-ethnic, multi-lingual higher education in South East Europe.

Moreover, it has succeeded in combining the best of European and United States experience, continuing to benefit from academic collaborations sponsored by the EU Commission and USAID, among other donors. It benefits from scholarship support



provided by The Netherlands and The Open Society Institute. Its history is a fascinating account of how SEEU has reached this position of strength against a background of political and economic uncertainties in the region. Now SEEU reaches out to other institutions in promoting research collaboration, exchange of students and staff and to its community.

The faculties in SEEU are:

- Contemporary Sciences and Technologies;
- Languages, Cultures and Communications;
- Public Administration and Political Sciences;
- Business and Economics;
- Law.

Besides faculties, SEEU hosts several centers and institutes dedicated to teaching and research:

- Institute for Environment and Health;
- Instructional Support Center;
- Business Development Center;
- Computer Center;
- ICT - Research and Training Center;
- Language Center;
- the Certificate in English Language Teaching to Adults (CELTA).

1.2.2 The Institute for Environment and Health

The University commitment towards climate change and environment preservation flows into a sustainability-oriented institute, the Institute for Environment and Health (IEH).

The Institute for Environment and Health was founded in November 2005, with the aim to provide organizational and development activities, science research and to promote and strengthen awareness and partnerships for protecting and improving the environment and health in regional and global level. The institute is interdisciplinary, comprising 10 academic staff, 5 external research associates, 30 research students and 3 administrative staff. The Institute is well equipped for field-based studies and has adequate computing facilities. Its contribution consists in progressing environmental and health issues, providing and develop program studies with adequate literature, good conditions for science-research activities, promoting environment and health through public awareness, maintaining the library with literature permanently and increasing the level of impact and professionalism through partnerships and corporations with regional and international institutions and organization.

The mission of the Institute for Environment and Health at SEEU is to develop technical and scientific information related to environmental topics, and also training of human resources in order to inform the society on environmental and health thematic, in addition to providing support for decision making processes, encouragement of environmental protection, and promotion of sustainability during usages of natural resources.



The IEH vision elements and values are:

- modern education;
- advance science research;
- multi disciplinary aspect;
- discipline;
- diversity;
- partnerships.

Accordingly, the main fields of activity and objectives of the Institute are:

- to promote studies of environmental sciences in all levels of formal and informal education;
- to support, encourage and undertake research in the field of environmental studies;
- to organize, manage and include: conferences, seminars, symposiums, workshops, as well as to provide high-quality personnel to lecture and demonstrate all aspects of environmental disciplines;
- to publish newspapers, books, reviews, booklets and brochures with the purpose of better information of all levels of population;
- to advice and help the Government and its Agencies on environmental issues with a wide public interest;
- to facilitate fruitful collaboration within governmental and nongovernmental institutions, societies and other organizations;
- to collaborate and be member of international organizations of the same field;
- to create and raise awareness of population regarding environmental issues in order to prevent and increase quality of life.



Figure 1.1: Headquarters of the Institute for Environment and Health

1.3 WHY THIS CAP

The SEEU has committed itself to reduce its greenhouse gas emissions and serve as the University country leader in the campaign to fight the climate change. Although Macedonia has no binding reduction commitments deriving from the international climate change regime (in particular from the Kyoto Protocol), the voluntary engagement of SEEU in a greener direction demonstrates an open mind and careful approach to the global environmental problems.



The scope of the SEEU CAP is not only to measure and reduce its GHG emissions, but to develop and implement measures to achieve climate neutrality by eliminating or offsetting those emissions. In fact, as society's source for ideas, universities have a crucial role to play in climate mitigation: they can both generate new knowledge, solutions and technologies, and at the same time reduce their own, carbon footprint, which is not negligible.

The CAP identifies the emission reductions of each project and sets an implementation schedule over the short, middle and long term that will ensure that the Campus can make steady progress toward its climate goals. This Climate Action Plan follows the experiences of the first wave of schools all over the world (i.e.: Buffalo, Santa Barbara, Maryland, Montana and other U.S. campuses under Association for the Advancement of Sustainability in Higher Education), which implemented carbon-cutting initiatives showing that a good planning is the best way to ensure good results (Eagan, Calhoun, Schott, Dayananda, 2008).

2 METHODOLOGICAL APPROACH



The objective of this Climate Action Plan is to outline strategies and a timeline for reducing greenhouse gas emissions. It is not a detailed engineering analysis of the proposed ideas. Cost estimates are best guesses.

Completing this Climate Action Plan was undertaken as a community effort. A public involvement process was designed and implemented through public meetings, stakeholder meetings and surveys. Ideas to reduce greenhouse gas emissions were collected and analyzed using the Clean Air-Cool Planet Campus Carbon Calculator (CA-CP, 2008). Strategies were then prioritized and a timeline developed to establish emission reduction interim goals and a target date for carbon neutrality.

The greenhouse gas emissions reduction strategies originated from the Technical Working Group analysis of the GHG inventory and of the applicable future implementation scenarios. The WG was tasked with developing strategies from these ideas and analyzing them based on costs, savings, and GHG reduction potential. Members of the Technical Working Group included:

- Mr. Alajdin Abazi – Rector Emeritus;
- Mr. Murtezan Ismaili – Director of the Institute for Environment and Health;
- Mr. Iljaz Iljazi – Institute for Environment and Health;
- Mr. Darko Spirovski – Institute for Environment and Health & Energy Department.

The data used to analyze strategies were derived from a number of sources including:

- the 2010 Greenhouse Gas Inventory;
- energy audits conducted by D'Appolonia consultants;
- results of similar strategies implemented at other U.S. universities;
- literature review;
- university and local experts;
- Clean Air Cool Planet (CA-CP) Campus Carbon Calculator, version 6.4.

In devising strategies for greenhouse gas emission reductions, the CAP Technical Working Group has taken a pragmatic, common sense approach. A first pillar was to invest in renewable energy, energy efficiency and conservation measures before considering carbon offset purchases for the remaining emissions.

The CAP Technical Working Group met over the course of years 2009 and 2010 to better understand campus conditions and challenges and set feasible emission reduction and programmatic goals and targets that will lead to verifiable outcomes. Given the complexity of its task, the CAP Technical Working Group made assumptions and devised strategies with the understanding that this long-term



strategic plan would need to be periodically revisited and updated to reflect internal changes and external circumstances.

Given the operational, technical, and behavioral changes needed to reach carbon neutrality, University faculty and staff need to be educated about the issue and motivated to develop low carbon ways of doing business. A number of initiatives are underway or planned that can support employee education and action. Going forward, every employee needs to consider the carbon implications of their decisions and actions, both on the job and as they commute to campus.

The Campus continuous growth is foreseen; the main issue to solve is how the campus will expand and improve having in mind its commitment to carbon neutrality. Energy usage has been relatively stable over the period of the GHG inventory. While economic conditions may slow campus growth in the near term, growth will occur as the University enhances its facilities, including the energy plants, the construction of additional dorms, laboratories, and data centers.

CAP Technical Working Group members discussed how there are inherent conflicts between growth and carbon neutrality. The Campus needs to address these issues directly, carefully considering what is truly needed in terms of new facilities, where on campus they should be built, and how this can be accomplished within the framework of carbon neutrality and green campus.

3 GREENHOUSE GAS EMISSIONS INVENTORY



The first necessary step for tailoring the sustainable interventions for the reduction of energy consumption and GHG emissions is the realization of a GHG inventory. An inventory quantifies where and how many emissions are generated within the spatial boundaries of the campus. SEEU issued its GHG inventory on July 2010 (D'Appolonia/SEEU, 2010), reporting emissions for the fiscal years 2005-2009 and with specific reference to fiscal year 2009.

3.1 INVENTORY METHODOLOGY

The inventory is based on the CA-CP Campus Carbon Calculator (CA-CP, 2008). The CA-CP methodology follows guidelines outlined in the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) GHG Protocol Initiative. The CA-CP Campus Carbon Calculator is based on international recognized emission factors databases to convert the emission sources into carbon dioxide equivalent emissions.

The calculator enabled easy entry and conversion of collected data to its carbon dioxide equivalent based on global warming potential. The CA-CP Campus Carbon Calculator inventoried all six greenhouse gases outlined by the Kyoto treaty. It adapted protocols established by the Intergovernmental Panel on Climate Change (IPCC) for national-level GHG accounting for use at an academic institution (IPCC, 2006a). The calculator is a Microsoft Excel workbook comprised of a series of spreadsheets that compute estimates of GHG emissions associated with campus activities (energy use, agriculture, refrigerants, solid waste management) and produce charts and graphs that illustrate changes and trends in emissions over time.

3.1.1 Definition of the Boundaries

The first step in developing the inventory was the definition of organizational, operational and temporal boundaries. The activities considered as Campus GHG emissions included all those outlined in the WRI/WBCSD GHG Protocol. The definition of the organizational boundaries for the realization of the GHG inventory was based on the physical extension of the SEEU Campus itself. The boundaries, therefore, included all the existing objects located inside the Campus. These boundaries also included the roads and the fields included within the fence of the Campus. Since there are GHG emissions associated at some point with nearly every action and every product, the selection of operational boundaries is a key aspect of carbon management.

GHG Protocol established a set of standards that enable organizations to define the operational boundaries for their GHG accounting and reporting endeavors.



The Protocol defined three scopes as follows:

Scope 1: Direct GHG emissions

Direct GHG emissions occur from sources that are completely owned or controlled by the institution; this includes, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment.

Scope 2: Indirect emissions from purchased electricity, heat and steam

Scope 2 accounts for GHG emissions from the generation of purchased electricity, heat or steam consumed by the institution. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the institution. Scope 2 emissions physically occur at the facility where electricity is generated and not at the user site.

Scope 3: All other indirect emissions

Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the institution, but occur from sources not owned or controlled by it.

With reference to the SEEU Campus, the operational boundaries include:

- Scope 1 emissions from diesel oil fuelling centralized heating system and the University car fleet plus fugitive emissions from hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) from HVAC systems;
- Scope 2 emissions from purchased electricity;
- Scope 3 emissions from faculty, student, and staff commuting in individual-owned vehicles, air travel for University-related business and landfill emissions caused by University-generated waste (MMEPP, 2009).

The operational boundaries do not include business travels in non-university owned cars or upstream production of materials (e.g.: paper), equipment (e.g.: computers), or infrastructure (e.g.: building materials) used on campus.

The following Table 3.1 summarizes the GHG emissions by scope and type.

Table 3.1: Emission Sources Included in the GHG Inventory

Emission Source	Scope	GHG
Centralized Heating System	1	CO ₂ , N ₂ O, CH ₄
Vehicle Fleet	1	CO ₂ , N ₂ O, CH ₄
Agriculture	1	N ₂ O, CH ₄
Refrigerant Releases	1	HFCs, HCFCs
Purchased Electricity, Heat and Steam	2	CO ₂ , N ₂ O, CH ₄
Air Travel	3	CO ₂ , N ₂ O, CH ₄
Commuter Traffic	3	CO ₂ , N ₂ O, CH ₄
Solid Waste Management	3	CH ₄



It must be noted that the GHG Protocol requires accounting for Scope 1 and Scope 2 emissions, whereas Scope 3 analysis is optional. According to the relevant contribution to the overall campus emissions due to air travels, commuter traffic and waste management, it was chosen to include also Scope 3 emissions in the inventory.

Regarding the temporal boundaries, the inventory covered a period of six years from Fiscal Year (FY) 2005 to 2010; FY in SEEU is meant to begin on September 1st and to end on August 31st (note: the fiscal year is named after the end date year, so for example FY 08/09 = 2009). Data were not available across all emission categories for earlier years. The main figures of this inventory are referred to the most updated data upon FY 2009.

Gathering data prior to 2005 was difficult because either records have not been kept or were not easily accessible. It must be noted that the SEEU campus opened in October 2001, so it was not possible to trace back to 1990, as usually referred to in similar campus inventories.

3.1.2 Assumptions and Limitations

The accuracy of data for the inventory was affected by possible weaknesses due to gaps in available data, thus implying the adoption of assumptions and the use of simplified methodologies. In setting the operational boundaries, the principles outlined by the GHG Protocol were followed but the analysis was in some case influenced by the availability of data of reasonable quality (i.e.: what SEEU is already measuring, or what could be assumed from something that SEEU is measuring). The main data gaps were related to records on transport before 2005, details on fuel use, waste collected amounts, refrigerants leakage.

To solve these possible issues, simplified methodologies were used to calculate and/or extrapolate the emissions associated with the abovementioned categories of activities.

The SEEU GHG inventory includes many of the emissions generated on campus and through SEEU-influenced activities; however, it can only provide a partial picture of SEEU's contribution to global climate change. A complete approach for the determination of the campus related emissions should consider the lifecycle analysis of each product included in the campus activities (such as paper, desks, chairs, computers, and building materials are all processed, manufactured, and transported to and from market) which are responsible of many Scope 3 emissions which are out of the direct control of SEEU. These contributions were considered outside the boundary of the emissions inventory.

3.2 CALCULATION OF GHG EMISSIONS BY SOURCE

The CA-CP Calculator v.6, developed by Clean Air – Cool Planet specifically for universities, was used to create the GHG inventory for SEEU. Activity data (i.e.: liters of fuel, kWh of electricity, commuter trips, miles of air travel) were converted into tons of equivalent carbon dioxide (tCO₂e) using the related emissions factor (e.g.: kg CO₂/kWh, kg CH₄/kg_{waste}). The following sections resume the calculated emissions by source.



3.2.1 Data Collection

The CA-CP Campus Carbon Calculator is divided into broad data collection categories. Most of the data were provided by the SEEU technical team filling in the CA-CP input worksheet with data relevant to fiscal years from 2005 to 2010.

Where data were either not recorded or not sufficient, assumptions were made in order to fill in all the input data cells of CA-CP worksheets.

During FY 2009, SEEU recorded 4,962 full-time students (of which 440 resident students), 646 part-time students, 224 faculty and 128 staff at the University for a total community membership of 5,960 people. The following diagram (Figure 3.1) shows the trend in population for SEEU during the inventory years.

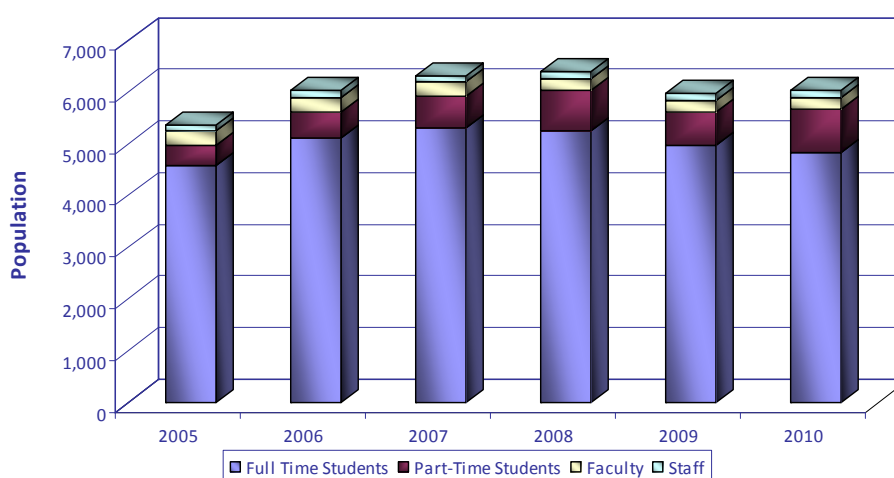


Figure 3.1: Campus Population over FY 2005-2010

3.2.2 On Campus Stationary Sources

The University’s on-campus stationary sources of GHG emissions only include the centralized heating system fuelled with fuel oil (Mazut). It meets all the SEEU’s heating demand, about half of its electricity demand, and provides some chilled water for air conditioning. Fuel use data were provided by the Energy Office, Facilities Management.

Fuel oil (Mazut) is used to feed the boilers for the centralized heating system. There are two boilers serving the Rectorate building, three boilers serving the remaining buildings and one boiler for the restaurant. These boilers were installed in 2007 and 2001-2004, respectively. The consumptions rose from 170,000 liters per year up to 200,000 liters per year of fuel oil in 2009.

Mazut oil has a big impact on GHG emissions due to its high emission factor; with specific reference to SEEU situation, the large amounts of fuel used for heating the whole campus imply that mazut related emissions play an important role in the inventory.

For academic years 2005-2009, total mazut oil usage was provided by SEEU energy manager.



3.2.3 Electricity

There is no electricity generation on campus (except two back up diesel generators for emergency); GHG emissions occur due to the generation of the electricity purchased from the national electricity provider. Since electricity is the main source of energy along the campus (lighting, air conditioning, dormitories equipment, etc.), it results to be one of the main sources of GHG emission at SEEU.

All the electricity consumed for the campus needs is purchased from the national power grid. Purchased electricity data were available for each fiscal year and were provided by the Energy Office, Facilities Manager, based on monthly invoices.

Entering kWh data in the CA-CP Calculator, annual electricity consumption is converted into GHG emissions through the national emission factor of the electricity grid (which was specifically calculated) into tCO₂e.

3.2.4 Campus Vehicle Fleet

The CA-CP Carbon Calculator categorizes the vehicle fleet by fuel type (i.e.: gasoline fleet, diesel fleet, natural gas fleet). Annual fuel use was provided by the Administration Offices that operated the fleet and/or controlled the fuel-servicing supply. The campus vehicle fleet is limited to several cars for staff (professors and services) and a tractor. The yearly amount of fuel purchased for the use of cars directly owned by SEEU was recorded equal to 14,000 liters. No official record was available in order to distinguish between gasoline and diesel consumption; therefore the recorded consumption was assumed to be split into 50% gasoline and 50% diesel.

3.2.5 Solid Waste

Data on the amount of solid waste generated by the campus were calculated on the basis of number of containers and service frequency, provided by the Facilities Manager. SEEU campus is collecting the generated waste by means of large containers and small bins spread regularly along the campus. There are 40 large road containers having capacity of 1,100 liters and some small bins having capacity of 50 liters. SEEU's staff gathers the containers in a dedicated area and the municipal public utility collects them twice a week. During every shift, the public utility collects 20 containers and disposes the produced waste in the municipal landfill without CH₄ recovery. The yearly production is around 390 t. This value was obtained assuming a filling rate of containers of 75% and to an average density of municipal solid waste of 250 kg/m³; it was assumed that public utility's collection is carried out twice a week for 45 weeks along the year.

Solid waste management data assumed emission factors based on average composition of solid waste for Eastern Europe instead of the pre-configured values of CA-CP calculator: this value was set at 42.7 kgCH₄/t_{waste} (IPCC, 2006b).

The yearly amount of waste calculated for the reference fiscal year was projected to the other relevant years of the inventory in proportion to the population of the Campus.



3.2.6 Transportation: Students, Faculty and Staff Commuting

Quantifying the GHG emissions from commuter traffic proved to be one of the most challenging tasks. The goal of the commuter traffic component of the calculator is to estimate GHG emissions associated with annual km traveled to and from campus by University students, faculty, and staff. Due to a lack of transportation-related surveys, data on commuter behavior (e.g. carpooling, single occupancy vehicles, and commute distance and frequency) was not available. To estimate commuters' contributions to the campus carbon footprint, assumptions were made. Bus, Rail, and other commuter possibilities were not included due to both lack of data and negligible utilization of such solutions.

For the determination of GHG emissions due to car transport, the default emission factor for vehicles set in the CA-CP was considered not applicable, since it refers to the USA/Canadian average car fleet, whose cubic capacity is much higher than the European one. For this reason, the emission factor for vehicles was set at the average European level (0.17 kgCO₂/km) as indicated by Department for Environment, Food and Rural Affairs (DEFRA) of United Kingdom (DEFRA, 2008).

Assumptions were made for the calculation of the transportation's contribution, regarding usage of individual vehicle, carpool diffusion, number of days at the Campus, average trip traveled.

3.2.7 Air Travel

Air miles data were provided by the administration offices and covered business and study trips. This voice is considered negligible in the calculation, since the number of km traveled is very low (around 43,000 km/y for both staff and students). Anyway, the inventory took into account GHG emissions due to air travel.

The emission factor for air travels was set at 0.18 kgCO₂/km per person, in accordance with DEFRA passenger air transport emission factors for European routes (DEFRA, 2008).

3.2.8 Refrigerants and Chemicals

Data on refrigeration and other chemicals were not readily accessible since SEEU is not keeping track of them. Although the IPCC suggests that GHG inventories should not account for CFCs since they are being phased out by the Montreal Protocol and Clean Air Act Amendments of 1990, CFC were not excluded from the inventory and were accounted for based on the following assumptions.

It was chosen to follow a conservative approach, thus considering that during the reference period 2005-2010, the refrigerants of all the air conditioners were replaced once. The Rectorate is served by a large plant, 300 kW rated power, while around 100 air conditioners with rated power 3.5 kW are locally installed all along the Campus.

3.2.9 Agriculture

Since no animals and agriculture activities are carried out by the Campus, the agriculture section of the Carbon Calculator is not covered by the present inventory.



3.3 INVENTORY RESULTS

3.3.1 Total GHG Emissions

The following diagram (Figure 3.2) illustrates the GHG emissions profile over the inventoried years.

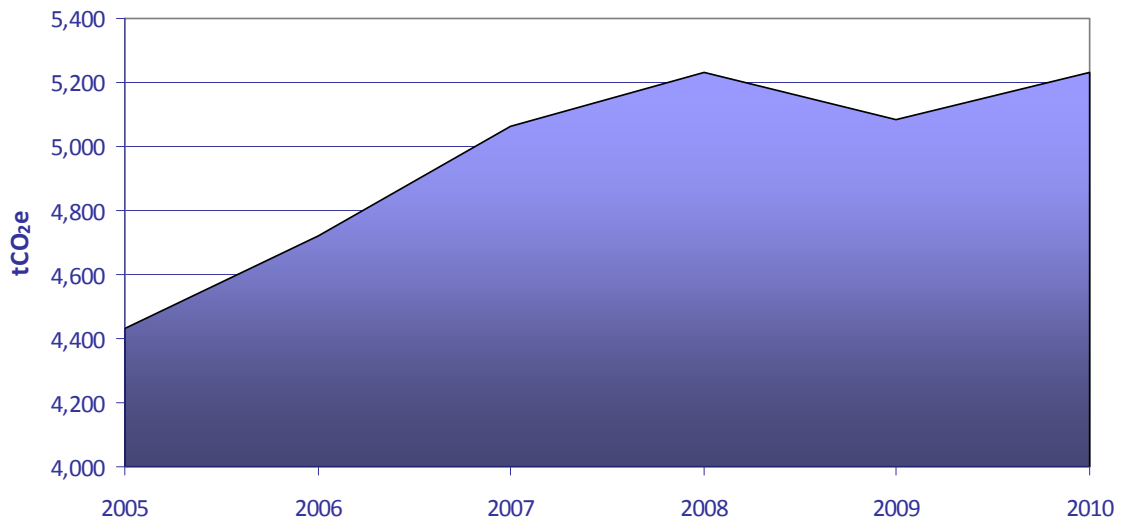


Figure 3.2: Total Campus Emissions

According to the figures of the diagrams, the overall GHG emissions, after an increasing trend in FY 2005-2008, registered a decrease in FY 2009, while for FY 2010 a new increase to the 2008's value is predicted.

The rise in overall emissions in the first years can be attributed to the campus' growth (population and surface) and the expanded facilities infrastructure required to support the growth.

The decrease in FY 2009 is mainly due to the decrease in commuting in year 2009, caused by decrease in population. For the following year, the population remained constant, even though a slight increase in electricity consumption is expected, which could bring the overall emissions to the same values of year 2008.

Figure 3.3 shows the contribution to the total GHG emissions by Scope. Table 3.2 displays all the contributions by scope to the yearly overall emissions in tCO₂e. It is highlighted that, on the average, Scope 1 is responsible for approximately 13% of the total emissions, Scope 2 for 37% and Scope 3 for approximately 50%.

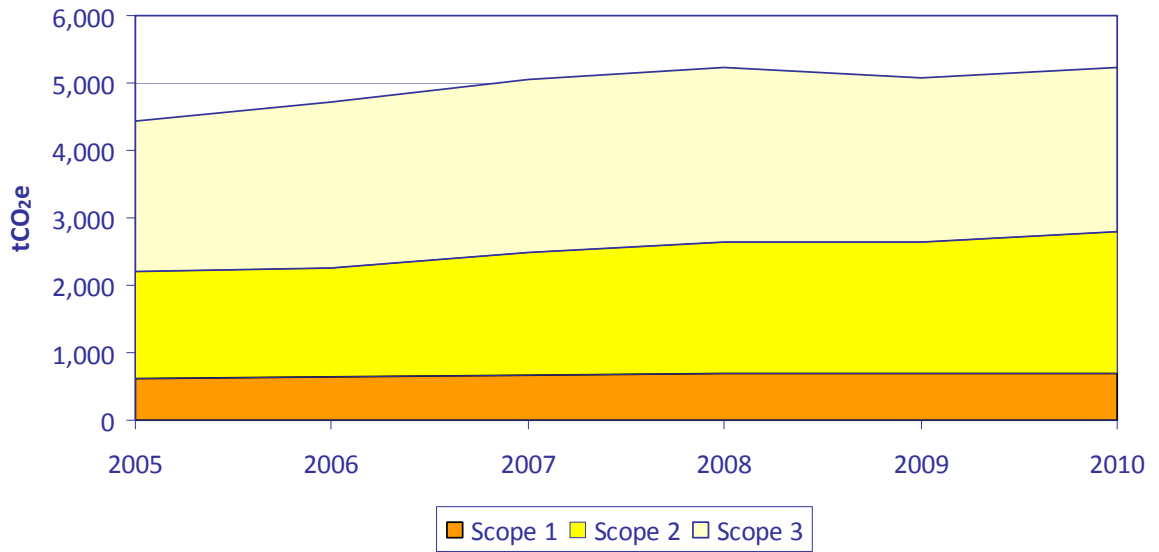


Figure 3.3: Total Campus Emissions by Scope

Table 3.2: Contribution to Total Emissions by Scope

FY	Total Emissions	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
	t CO ₂ e/y	t CO ₂ e/y	t CO ₂ e/y	t CO ₂ e/y	%	%	%
2005	4,433.1	607.8	1,592.3	2,232.9	14%	36%	50%
2006	4,722.3	639.3	1,605.5	2,477.5	14%	34%	52%
2007	5,062.5	670.7	1,816.4	2,575.4	13%	36%	51%
2008	5,229.1	702.1	1,950.2	2,576.7	13%	37%	49%
2009	5,084.5	702.1	1,950.2	2,432.1	14%	38%	48%
2010	5,229.5	702.1	2,092.0	2,435.3	13%	40%	47%

3.3.2 Figures by Source

The greenhouse gas emissions inventory revealed that SEEU campus emitted approximately 5,100 tCO₂e in FY 2009.

The following diagrams show the contribution of each inventoried sector to the GHG emission. Figure 3.4 presents the contribution of each sector in percentage on the total emissions for FY 2009: the main contribution comes from commuting (42%), followed by electricity consumption (37%); on-campus stationary combustion accounts for 12% and solid waste for 7%; the other contributions (direct transportation, refrigerants and air travels) are negligible (around 1% each).

In Figure 3.5 the sectoral emissions in tCO₂e are presented in cumulative chart for the reference period.

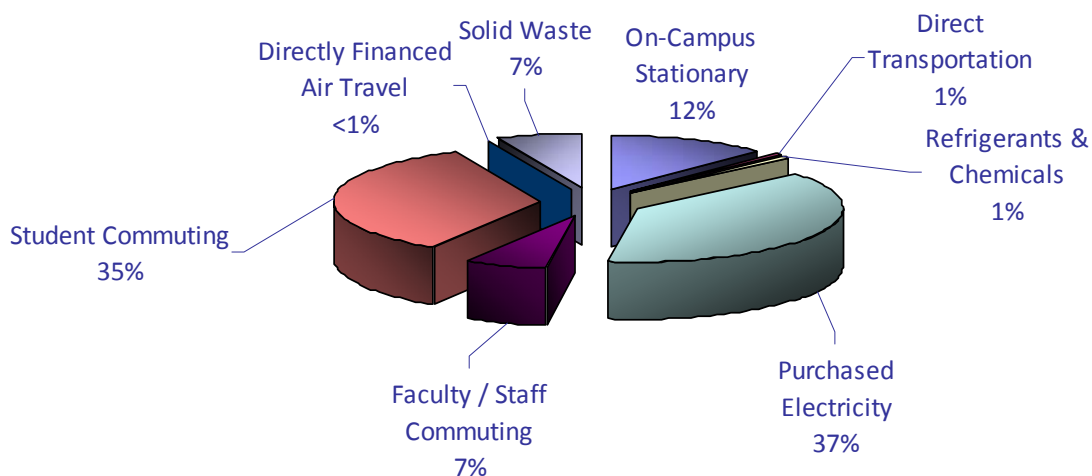


Figure 3.4: GHG Emissions by Sector – FY 2009

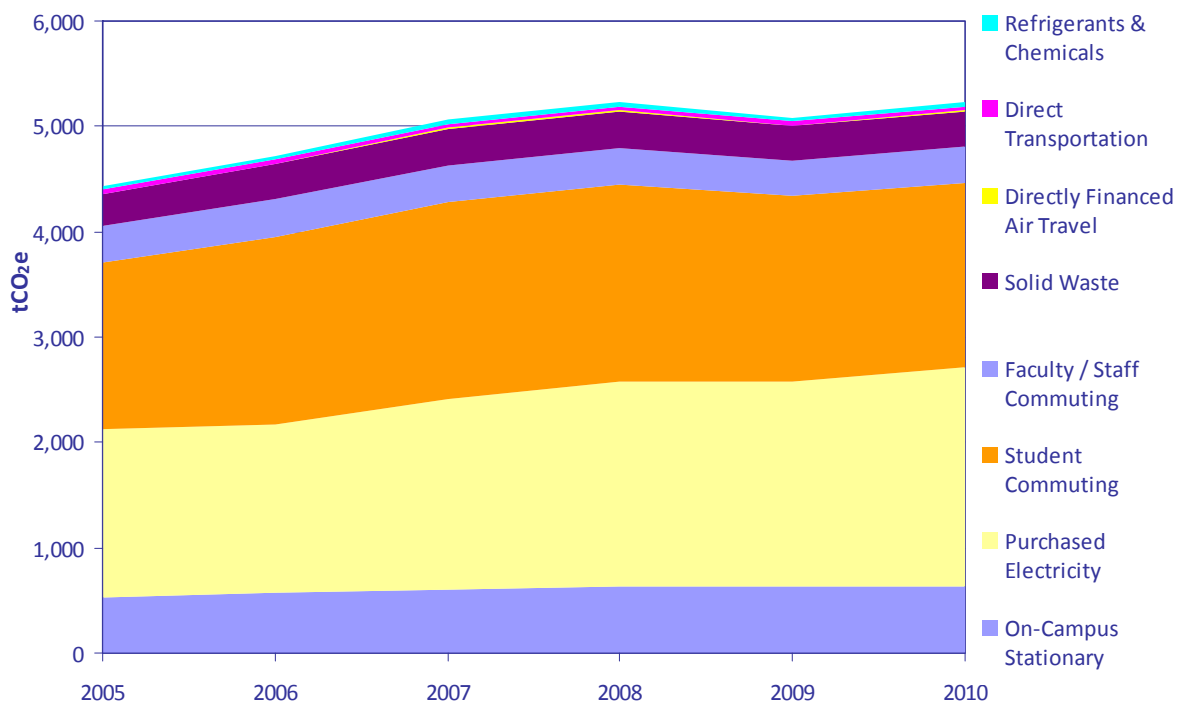


Figure 3.5: GHG Emissions by Sector

The following Table 3.3 resumes the outcomes of the inventory in terms of CO₂e emissions by source.

GREENHOUSE GAS EMISSIONS INVENTORY



Table 3.3: GHG Emissions by Sector

FY	On-Campus Stationary	Purchased Electricity	Student Commuting	Faculty / Staff Commuting	Solid Waste	Directly Financed Air Travel	Direct Transportation	Refrigerants & Chemicals
	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y
2005	534.4	1,592.3	1,586.0	339.5	298.7	8.8	35.9	37.6
2006	565.8	1,605.5	1,781.8	352.5	336.3	7.0	35.9	37.6
2007	597.2	1,816.4	1,866.7	346.8	353.1	8.8	35.9	37.6
2008	628.7	1,950.2	1,873.2	338.5	357.1	7.9	35.9	37.6
2009	628.7	1,950.2	1,758.1	333.2	332.9	7.9	35.9	37.6
2010	628.7	2,092.0	1,746.8	344.1	336.5	7.9	35.9	37.6

4 GHG REDUCTION STRATEGIES



SEEU has detected strengths in GHG emission reduction sectors of energy conservation and efficiency, green building design, alternative transportation and solid waste management and recycling. Acting according to these strengths, as well as delineating others, will allow SEEU making significant reductions in its GHG emissions over time.

The strategies are categorized according to the GHG Emission Reduction Sectors outlined below:

- policies;
- energy efficiency;
- renewable energy;
- transportation;
- waste management;
- carbon offset.

4.1 CAP GOALS

4.1.1 Emission Reduction Target

The University management has set an interim reduction target by 2020 equal to 30% of the current GHG emissions.

According to the strategies outlined in this CAP and to the related calculations, the Campus emissions can be decreased of 34.8%. This important result does not include the possible contribution of the carbon offset mechanism, which will be additional.

The 2020 deadline is likely to be respected, but the actual implementation of some projects, depending on the funding system, can be delayed and fulfilled by 2030.

The University management also aims at pursuing 100% emission reduction, i.e. carbon neutrality, by 2030 as a challenging ambition.

4.1.2 Approach for Selecting Mitigation Mechanisms

The desired targets are listed with respect to a logical methodology. Several attempts have been made in order to fully assess the set of possibilities for SEEU.

The CAP priority actions could be implemented according to different scenarios, based on the following key criteria:



- marginal cost of reduction (€/tCO₂e): ranking of priorities can be done according to this performance indicator, which gives the ratio between the Net Present Value (NPV) and the emission reduction over the project lifetime;
- emission reduction potential (tCO₂e/y): SEEU could start implementing those actions having higher annual emission reduction potential, thus giving priority to photovoltaic, lamps replacement and carpool/public transport policy; the actions having lower annual emission reduction potential will be completed by 2020;
- capital cost (€): a third simulation is based on projects ranked by capital cost; policies would be implemented first, followed by low-cost interventions and finally by big investments such as photovoltaic and foundations insulation.

After an analysis of these three opportunities, the first approach was considered to better fit the University's situation.

The initial choice will fall on zero or low cost projects. Of course, the emission reduction targets can be only partially solved by means of these zero capital cost projects. After this initial phase, therefore, priority will be given to actions with the best ratio between the economic viability and the emission reduction potential, reflecting the University's preference for mechanisms that guarantee a quick payback.

Finally, the last mitigation strategy is represented by the purchase of carbon offsets. Once all mechanisms with costs below the price of external offsets have been exhausted, the University can meet all additional emission reduction targets through the purchase of carbon offsets.

4.2 POLICIES

Sustainability requires a paradigm shift in how the campus operates. The CAP Technical Working Group discussed a number of near-term strategies for reducing emissions through administrative policies. These discussions focused initially on campus-wide policies needed to support institutional and individual changes that will reduce campus emissions.

The specific implementation strategies that would accompany the policies are included in the following chapters. Administrative policies are needed to support many of the Climate Action Plan strategies outlined in this document.

A main tenet of the policies proposed by the Technical Working Group is to make the campus community aware of its role in reducing energy wastes in every field – buildings, transport, waste collection – and the resulting GHG emissions.

4.2.1 Behavior Modification and Occupation Awareness

One of the most cost-effective ways to save energy and reduce GHG emissions is through changing energy-consuming habits and behaviors.

Low attention is usually devoted to raising the consciousness of energy end users on campus. Since students, staff and faculty do not directly pay the utility bills, the campus building occupants often have little low perception of the importance of energy conservation; evidence suggests that a significant opportunity exists to reduce energy load through modifying occupants' behavior. Education and social marketing can result in energy-conscious actions such as turning off unneeded



lights, adjusting building temperatures, shutting off equipment, using less hot water, and closing windows and doors.

To optimize this strategy, staff should be dedicated to accomplish the needed tasks. Students, along with faculty and staff, shall be involved in the process, working on behavior changing campaigns and initiatives along with monitoring success rates.

Research shows that energy savings from behavior modification varies widely (Markowitz & Doppelt, 2009), ranging from a 5% reduction to as much as 56%, although this higher percentage was for only a two week period. A more reasonable range is 5-30%.

Due to the fact that the campus dependence from electricity is related to a huge variety of fields and not only limited to offices occupation (e.g.: external lighting), the range considered in technical literature about U.S. standards appears oversized; for this reason, the CAP Technical Working Group estimated energy savings target from behavior modification could be set conservatively at 1% of the total purchased electricity. The energy saving potential is related to electricity consumption which is depending on space lighting, air conditioning and electrical appliances utilization.

A concrete possibility of energy saving in the field of behavior modification is to encourage energy saving methods of living such as:

- to turn down the heating system;
- to use less AC system;
- to turn off the lights when leaving the premises and to exploit natural light as much as possible;
- to power down equipment;
- to unplug chargers when not in use;
- to fill washing machines and dish washers completely before using;
- to use lids on pots when cooking;
- to completely shut off devices instead of using power standby modes;
- to shut off water heaters when not using;
- to save water when taking showers.

Moreover, during summer session and over breaks few people are in the Campus. Therefore, it may be possible to combine areas of use and to close some buildings. Energy savings would then be achieved due to lower heating and cooling needs, less lighting and equipment use. Deeper analyses are needed to exactly define which rooms could be closed. Events and staff schedules need to be considered.

There are also possibilities at the Campus level, depending on the management policies. Possible examples are:

- to initiate energy saving competitions across the Campus;
- to meter buildings separately and make sure meters are accurate;
- to quantify and measure results of energy conservation;
- to celebrate and reward individual, departmental and building-wide successes.

The only cost associated with this strategy is for staff to implement awareness campaigns and to track progress.



One of the most significant barriers to this strategy is the present inability to measure results accurately. In order to do this, a metering system or some other method of measuring energy savings would be needed. Lack of evidence of the results from behavior modification policies could represent a barrier to gain reliability and long-term commitment to the strategy.

Two mechanisms are suggested to help raise awareness of the building occupants: the first is to make available department energy use data; the second is to create a reward for departments achieving energy conservation. Both mechanisms would require the installation of additional building level meters for electricity.

Publicly available data on energy consumption would encourage individuals to be mindful of their energy consumption. Rewarding departments for energy conservation may help to start a sort of competition among departments, resulting into additional efforts to reduce energy usage at the individual level. Giving departments a prize, or other reward to be defined, for reducing energy load below some baseline or relative to other departments may help to motivate departments and individuals to more actively reduce their energy usage.

As for the energy saving calculation, the reduction of 1% of the total electricity demand for the campus would result in 20,400 kWh/y electricity saving (basing the calculation on the current consumption). SEEU purchases electricity from the national grid, therefore the emission reduction originating from such intervention depends on the electricity emission factor of the grid. Having in mind that the CEF has been calculated equal to 0.956 tCO₂e/MWh, the emission reduction for this intervention amounts to 19.5 tCO₂e/y.

Table 4.1: Behavior Modification Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Behavior Modification	19.5	-	32 (saving)	15,690	-	25	0.4%

4.2.2 Carpool/Public Transport

In 2009 transportation emissions, including those from the University fleet, student, faculty and staff commuting, and air travel accounted for 43% of all SEEU emissions. Commuting is the major source of greenhouse gases emissions and yet that contribution is not directly depending on the University itself, thus the applicability of proper mitigation strategies is difficult.

With few options for public transportation throughout the region, traveling by personal vehicle is popular among students and thus many students bring their car to the Campus. Unless better public transportation methods will be set up at regional level, private car will remain the only way to get to the campus.

Empowerment of carpool habit is necessary; the GHG inventory showed that the current single-occupancy vehicle utilization share is 40% against 50% of carpooling (2 people per car); the strategy of carpooling empowerment must be aimed at raising carpool share of 10%.



A second sustainable measure is SEEU participation in regional partnerships for the institution of a local transport system, currently missing. SEEU could participate in the definition of strategies and in funding a local bus system to allow students to get to the Campus. The service can be thought for the local connections in Tetovo and for intermunicipal trips (e.g.: from/to Skopje), getting to a total share of utilization of 25%. In this way, single-occupancy vehicle would impact only for 25%, carpooling for 40%, bus for 25%; the remainder would remain on foot or bicycle. SEEU partnership could give an impulse to the municipality for the creation of the service.

Calculations for emission reduction were based on the fuel consumption of vehicles and showed that the net emissions flux can be reduced of 7.1%. This calculation was based on a distance-based approach: the emission reduction was calculated according to the traveled kilometers in the current scenario against the traveled km after the implementation of the sustainable measures; this led to estimate total emission reduction of 360 tCO₂e/y.

Table 4.2: Carpool Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Carpool	360	500,000	191 (saving)	2,450,000	2	25	7.1%

4.3 ENERGY EFFICIENCY

4.3.1 Plants Upgrade

The Campus offers significant energy saving opportunities through the improvement of buildings infrastructures. The following key interventions can be foreseen:

- HVAC system substitution;
- lamps replacement and lighting motion sensors and timers;
- ventilation changes;
- solar thermal and photovoltaic installation;
- shading structures;
- foundations insulation.

As illustrated in Section 4.9, a pilot building was accurately chosen in order to design and realize energy efficiency measures, with the aim to guarantee the replicability of the proposed interventions on similar buildings along the Campus.

Based on the outcomes of the pilot project, some interventions can be figured out for the Campus as a whole, with special focus on the other similar buildings. Additional energy efficiency measures should be tailored to the specific categories of building destination, namely the rectorate, the classrooms and the dormitories.

4.3.2 Fuel Switch

In 2009 on-campus stationary combustion in the centralized heating system accounted for 12% of campus greenhouse gas emissions.



The system is currently fuelled with approximately 200,000 liters per year of Mazut (diesel), a highly pollutant fuel oil. The use of alternative fuels is under assessment because it could result into fuel savings and, above all, notable emission reduction. Assumed the same final energy demand, three possibilities have been compared to diesel: methane, LPG and biomass (wood chips).

Some operational parameters of alternative fuels are resumed in the Table 4.3 below.

Table 4.3: Comparison of Alternative Fuels

	Mazut	Methane	LPG	Biomass
Net Calorific Value	41.3 MJ/kg	36.8 MJ/Nm ³	46.2 MJ/kg	10.8 MJ/kg
Unit Cost	0.7 €/l	0.55 €/m ³	0.59 €/kg	20 €/m ³
Emission Factor	0.278 kgCO ₂ e/kWh	0.202 kgCO ₂ e/kWh	0.227 kgCO ₂ e/kWh	0 kgCO ₂ e/kWh
Annual Demand	200,000 l	220,000 m ³	160,000 kg	670,000 kg
Annual Emissions	626 tCO ₂ e/y	422 tCO ₂ e/y	455 tCO ₂ e/y	0 tCO ₂ e/y

The potential of biomass is quite high in the region, due to abundant amounts of woods in the forests. The supply chain for biomass is likely to be implemented by some years.

Among the fossil fuels, methane has the highest potential in terms of emission reduction and fuel consumption, but an important barrier has to be overcome before switching to methane: there is no methane network in Macedonia so far, although the introduction of methane is foreseen by the next five years; LPG potential is high, as well, since both market price and CO₂ emission factor are lower than mazut and comparable to methane's parameters.

In the current scenario, fuel switch to methane or LPG is likely to be pursued by 2020; the switch to biomass can be put as a long-term target (2030), when the supply chain and the market are stable and ready for a successful implementation.

For comparison purposes, LPG was used as reference in the calculation of the energy/emissions saving potential.

4.3.3 Foundations Insulation

Following the analysis on the structures in the energy audits, it was verified that in the prefabricated structures the perimeter walls and the roofs have very good insulation capacities, whereas the foundations are characterized by a high transmittance capacity. The foundations were realized without laying down any insulating layer; this implies that in winter the dispersed flow through the ground is high, thus making foundations the main responsible for dispersions.

In order to reduce the thermal needs, the laying of insulating material is necessary.

This intervention is expensive and, although the benefits are high, it is not worth to be implemented if not coupled with other civil works on the structure.

The insulation of building foundations can lead to 20% savings on the winter thermal demand. This means that in case of insulation of the whole Campus surface (29,000 m²), 20% of the fuel consumption in the centralized heating system could be saved.



According to the emission factor for the mazut oil, saving 40,000 liters per year would result into GHG emission reduction of 125 tCO₂e/y.

In order to reduce the thermal needs, the realization of a proper layer of insulating material is suggested.

The most suitable solution for the buildings is a Styrodur layer with thickness 10 cm.

Table 4.4: Foundations Insulation Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Foundations Insulation	125	1,450,000	-359 (cost)	-1,124,000	36	25	2.5%

4.3.4 Lamps Replacement

The existing lighting system for alleys and interiors is constituted by fluorescent lamps and a mixture of non-energy efficient ones.

The proposed retrofit project would replace energy inefficient lighting with CFL or LED efficient lamps on the external posts for space illumination and with energy-saving lamps in the internal spaces. CFL light bulbs shall be provided to students living in the dorms to be used in their task lighting.

Following EU standard EN12464-1 of 2004, namely “Light and illumination – work spaces lighting – part 1 – internal work spaces”, the use of lamps with chromatic yield Ra higher than 80 is foreseen for fluorescent sources.

The energy audit estimated that, as first rough option, lighting upgrades across campus for the whole building surface of the campus (29,000 m² – ground level) will entail the replacement of up to a maximum of 10,000 lamps, also according to future optimization of the lighting system,

The total number of lamps was estimated according to the following assumptions: the installation of new lamps having the following characteristics is foreseen:

- rated power: 32 W;
- lighting efficiency: 100 lm/W;
- life cycle 15,000 h;
- Ra = 85.

Assuming space illumination for living spaces equal to 600 lux, and assuming an utilization factor of 0.5, the resulting needs are $600/0,5 = 1,200 \text{ lm/m}^2$, corresponding to approximately 12 W/m^2 (luminous efficiency for such a system is considered 100 lm/W). This means that each 32 W lamp is able to serve $32/12 = 2.7 \text{ m}^2$.

The substitution of 10,700 lamps will result in electricity saving equal to 230,000 kWh/y because the unit saving achievable through each lamp is approximately 21 kWh/y.



According to the emission factor for the national grid, this results in an annual GHG reduction of 221 tCO₂e; the energy saving will also imply the economical benefit for reduced electricity purchase from the grid.

Table 4.5: Lamps Replacement Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Lamps Replacement	221	150,370	4.9 (saving)	27,200	10	25	4.3%

4.3.5 Trees Plantation for Summer Shading

Planting trees on the south and west sides of some buildings could add shading in the summer and reduce the cooling needs. The trees should be deciduous to allow sunshine to warm buildings in the winter.

4.4 RENEWABLE ENERGY

4.4.1 Biomass

The installed centralized heating system, fuelled with mazut oil, is responsible for high consumptions of fossil fuels and related high amounts of GHG emissions. The system is annually fed by 200,000 liters of crude oil and its performance is quite good, since the boilers have been installed recently (in 2001, 2004 and 2007).

Biomass constitutes an opportunity due to the high potential of the region, which is rich in forests and wood residues. Wood chips can be considered among the alternative fuels in the fuel switch scenario. A strong and well managed local wood chain is required in the process, otherwise the wood procurement from far and scattered suppliers would make the system ineffective. The fuel switch opportunity was assessed in detail and compared to the use of methane and LPG in Section 4.3.2.

4.4.2 Solar Thermal

Domestic hot water is currently produced by means of electric boilers. Electricity is responsible of 37% of the global campus emissions and the considerable use of electric devices for the majority of the operations has a big share of responsibility.

Solar thermal is applicable to dormitories for domestic hot water production. The flat roof of the dorms buildings is suitable to solar thermal modules installation. According to the sector's literature, each person has a domestic hot water demand of 50 liters/day, which can be produced by 1 m² of solar modules at Macedonian latitudes. The number of lodged students amounts to 450, therefore the overall demand would be 22,500 liters per day. The needed surface of solar modules therefore amounts to 450 m².



The installation of solar thermal collectors could help covering the domestic hot water needs of the building, thus replacing the electric boilers or reducing their load.

Solar thermal systems can be thought as alternative solutions to either electrical boilers for domestic hot water production or boilers fed by geothermal heat pump systems (e.g.: the case of the pilot realization). The two possibilities have been assessed and the figures in the tables below allow comparison of the two scenarios. Due to the fact that the current situation in the dormitories is the presence of electrical boilers, the overall figures of energy saving and emission reduction are based on the replacement of electrical boilers with solar thermal systems.

In the case of solar thermal replacing electricity from geothermal heat pump systems, savings in electricity purchase from the grid have been estimated equal to 75,000 kWh/y (this depends on the solar radiation at the local conditions), resulting into emission reduction of 72 tCO₂e according to the emission factor of the national grid.

In the most likely scenario, the replacement of electrical boilers, savings have been calculated equal to 226,900 kWh/y, resulting into emission reduction of 217 tCO₂e per year.

Table 4.6: Solar Thermal Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Solar Water Heaters vs. Geothermal Energy	71.7	380,000	-179 (cost)	-322,000	77	25	1.4%
Solar Water Heaters vs. Electrical Boilers	216.9	380,000	-37.8 (cost)	-205,000	25	25	4.3%

4.4.3 Solar Photovoltaic

One of the main goals of SEEU is the reduction of dependence from external energy purchase. Of course, covering all the electric demand of the Campus with photovoltaic (PV) is a challenging objective, and a significant investment will be required. However, a considerable share of the demand can be covered through the installation of PV panels. The building roof surfaces are, in many cases, available and well oriented for PV installations. Besides, there are some free spaces which perfectly suit photovoltaic needs, such as parking lots and fields.

The main parking lot could be provided with PV car-shelters: its surface is approximately 2,000 m² and it could host shelters for an overall estimated amount of 200 kWp. In the local radiating conditions, this would allow producing around 230 MWh/y of electricity. Finally, the second parking lot is suitable to the installation of further 200 kWp, as well as the main one. Moreover, it is noted that the pilot building design has foreseen an installable capacity of 22 kWp. Covering the 5 twin buildings with this maximum solar capacity, this would lead to 110 kWp of photovoltaic



installation. The energy production related to these 110 kWp will be approximately 125 MWh/y. Summing up all the contributions for photovoltaic, the final goal for installation can be 500-510 kWp. Considering the local incoming solar radiation, estimated to be equivalent to 1,142 equivalent hours of sun per year, electricity production can be estimated equal to 570 MWh/y.

SEEU will be able to cover 28% of the current electricity demand through the installation of the total designed capacity of PV, thus reducing dependence from the grid purchase and generating clean energy. Applying the grid emission factor to the overall expected electricity production, the achievable emission reduction will be 545 tCO₂e/y, corresponding to more than 10% of the total emissions.

Table 4.7: Solar Photovoltaic Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
PV system	546	2,250,000	52.6 (saving)	717,700	8.8	25	10.7%

4.4.4 Geothermal

Geothermal heat pump has been designed for the pilot building as a single solution. An aquifer is available at few meters below the Campus surface, thus allowing a possible exploitation of such energy source. Theoretically, geothermal could be designed for the whole Campus, but the actual applicability shall be carefully evaluated after the realization of a specific hydrogeological investigation on the area, because the amount of water required by such a large scale system could generate impacts on the subsoil system.

4.4.5 Wind

Wind energy generation is considered only as a demonstrative action, for example installing micro turbines in a show case area. This is due to high implementation costs and lack of reliable analysis on wind potential in the area.

4.4.6 Buildings

The current situation of SEEU structures is stable and no new buildings are foreseen in the short term period. In case of new construction works, the passive house system shall be followed, considering the pilot project as a valuable example of sustainable building.



4.5 TRANSPORTATION

4.5.1 University Fleet

Although the campus fleet gives a very small contribution to GHG emissions compared to other campus sources, some fleet-related emissions reduction mechanisms can be thought.

The switch to different fuel sources would imply retrofitting interventions on the fleet, so that the benefits in terms of energy saving and CO₂ emissions would be low when compared to the investment.

SEEU may invest in low emission vehicles, such as hybrids and smaller vehicles. While more expensive, hybrids typically have almost twice the gas efficiency of non-hybrids by running on both gasoline and electricity generated from waste energy related to braking. The University may also improve fuel efficiency simply by purchasing smaller vehicles. This action is suggested for every new investment planned by the University.

Lastly, the University may also reduce emissions related to its campus fleet simply by encouraging staff members to reduce car trips, where not strictly needed.

4.5.2 Use of Videoconferencing

Air travel emissions account for a very low percentage on the total emissions, only 1%, but this is likely to increase as the University becomes a more prominent regional institution. Air travel emissions can be reduced both by providing tools that allow faculty and staff to avoid traveling to meetings (telecommuting) and by purchasing carbon credits to offset air travel emissions.

SEEU will implement actions aimed at the reduction of the number of travels, the energy saving and the emission reduction, through the incorporation of telecommuting and web conferencing capabilities into the University infrastructure.

The University can set up a videoconferencing center that is equipped with appropriate technology such as screens and microphones. SEEU will encourage the use of web conferencing technologies for meetings, collaborative work, conferences, consultations and to create virtual classrooms. Departments shall be encouraged to use video and teleconference tools to minimize travel costs. This allows students to get some information from home and avoid unnecessary travels; besides it also reduces the number of trips for faculty. Finally, it also enables faculty to establish e-learning programs that feature virtual classrooms.

The set-up of a new videoconference room is estimated to cost approximately 15,000 €, considering the necessary civil works and the equipment. If a target reduction of 50% saving on air flights and 40% on road trips is set, the overall goal of this action is to reduce the yearly emission of 33 tCO₂e, as illustrated in the table below, together with the other related parameters.

**Table 4.8: Videoconferences Potential**

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Video-conferences	33	15,000	189 (saving)	157,500	1	25	0.7%

4.5.3 SEEU Shuttles

A brand new Campus shuttle system can be realized. The service will be destined to local and intermunicipal connections, according to timetable to be properly defined.

The CAP approach foresees the operation of 3 new buses: 2 local and 1 intermunicipal. Daily trips to and from Skopje and local rides for the residents in Tetovo could be foreseen for attending the lessons. The buses will have electricity feed for batteries, thus replacing fossil fuel consumption. The shuttles capacity and the rides frequency should be evaluated according to the initial forecasts, and periodically refined on the basis of the success of the initiative.

Table 4.9 below resumes the potential of this initiative, calculated assuming:

- cost of shuttle buses: 25,000 €each;
- extra urban shuttle capacity: 20 seats;
- urban shuttle capacity: 40 people;
- number of extra urban shuttles: 2;
- number of urban shuttles: 1;
- number of urban and extra-urban trips per day: 4;
- number of trips to SEEU: 3 days per week, 38 weeks per year = 114 trips/y;
- average local trip (Tetovo – SEEU): 5 km;
- average extraurban trip: 25 km.

Table 4.9: SEEU Shuttles Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
SEEU Shuttles	41.77	50,000	36.05 (saving)	131,236	3.53	25	0.7%



4.6 SOLID WASTE

The Campus in 2009 has started a pilot project for the selective collection of paper in the Rectorate. Several bins are placed inside the building to introduce the process of paper recycling. It is suggested to extend this measure to the whole Campus, along with plastic collection.

The potential for paper and plastic collection is considerable in the SEEU Campus, especially because of books, sheets of paper, notebooks, etc. and plastic bottles. The final destination for such fractions should be carefully evaluated, since this action will be one of the first selective collection initiatives at national level.

The concrete actions to be undertaken are:

- definition of long-term contracts with recycling industries at regional/national level for the delivery of fractions after collection;
- realization of an awareness raising campaign addressed to students and staff;
- purchase of the needed equipment (bins or wheeled containers) to be located along the campus.

The realization of selective collection for other fractions, such as metals and glass, seems to be less suitable to the Campus situation, but it must not be excluded from a medium-long term strategy.

The proposed measure would place 4 waste containers (paper, plastic, glass, unselected waste) in each of the 20 points of waste collection that are already present on campus. Assuming a cost of 100 € for each container, it has been estimated a capital cost of 8,000 €. Since recycled material has no current market potential in Macedonia, economic benefits equal zero.

The following emission factors have been assumed:

- Glass: -30 kgCO₂e/t;
- Plastic: -41 kgCO₂e/t;
- Paper: -177 kgCO₂e/t.

The negative sign indicates that, based on the whole life cycle, recycling leads to a net reduction of CO₂.

Table 4.10: Selective Collection Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Selective Collection	2.79	50,000	-115 (saving)	-8,000	n/a	25	0.05%



4.7 SUMMARY OF EMISSION REDUCTION POTENTIAL

The following tables and charts resume the potential of emission reduction achievable through the implementation of the outlined strategies as defined in this Climate Action Plan.

Several indicators are presented in Table 4.11, and specifically:

- marginal cost of reduction: this indicator, in €/tCO₂e, is the net present value of the project per unit of GHG reduced (tCO₂e). The € term is a net present value (NPV) calculation, and includes the upfront costs and the discounted stream of future savings associated with the mechanism. The NPV calculation is then divided by the GHG savings over the lifetime of the project to yield the €/tCO₂e figure, which represents the net savings (or costs) to SEEU by reducing one ton of carbon dioxide equivalent using that particular mechanism;
- annual savings, in €/y, due to reductions in fuel consumption, electricity purchase etc, after the implementation of the sustainable actions;
- total savings in € over the total project lifetime;
- total capital cost in €;
- emission reduction is the potential of saving in tons of CO₂e/y achievable according to the selected goals and rated capacities for the outlined interventions;
- net emission reduction share indicates in % the emission reduction potential of each single intervention;
- cumulative Savings share;
- net Present Value;
- payback period.

The bubble chart in Figure 4.1 displays the estimated potential of emission reduction as calculated according to the described approach. The bubble size indicates the amount of emission reduction in tons of CO₂e; x-axis is related to the total investment cost whereas y-axis indicates the marginal cost of reduction in €/tCO₂e.

GHG REDUCTION STRATEGIES



Table 4.11: Overall Potential of Outlined Strategies - Indicators

Technology	Sector	Scope	Marginal Cost of Reduction (€/tCO _{2e})	Annual Savings (€/y)	Total Savings (€)	Total Capital Cost (€)	Emission Reduction (tCO _{2e} /y)	Net Emissions Share (%)	Cumulative (%)	NPV (€)	Payback (years)
Foundations Insulation	Energy Efficiency	1	-359	28,000	700,000	1,450,000	125.2	2.5%	2.5%	-1,123,700	52
Selective Collection	Waste Management	3	-115	-	-	8,000	2.8	0.1%	2.5%	-8,000	-
Solar Thermal	Renewable Energy	2	-38	14,975	374,385	379,506	216.9	4.3%	6.8%	-204,990	25
Lamps Replacement	Energy Efficiency	2	5	15,238	380,938	150,370	220.7	4.3%	11.1%	27,200	10
Behavior Modification	Energy Efficiency	2	32	1,346	33,660	-	19.5	0.4%	11.5%	15,690	-
Photovoltaic	Renewable Energy	2	53	254,666	6,366,650	2,250,000	545.9	10.7%	22.2%	717,770	9
Fuel Switch	Energy Efficiency	1	90	47,534	1,188,351	170,000	170.7	3.4%	25.6%	383,940	4
SEEU Shuttles	Transportation	3	156	38,121	953,034	150,000	75.5	1.5%	27.1%	294,250	4
Video-conference	Transportation	1,3	189	14,799	369,975	15,000	33.3	0.7%	27.7%	157,460	1
Carpool/Public Transport Policy	Transportation	3	191	252,787	6,319,687	500,000	359.7	7.1%	34.8%	2,445,880	2
Carbon Offset	Multi-task	1,2,3				2,542	508.5	10.0%			



Figure 4.1: Emission Reduction Potential



The column charts in Figure 4.2 and Figure 4.3 illustrate in two different display modes the potential of emission reduction divided per Scopes, as per definition from the WRI/WBCSD methodology. The benefits deriving from the proposed strategies are outstanding and clearly identified.

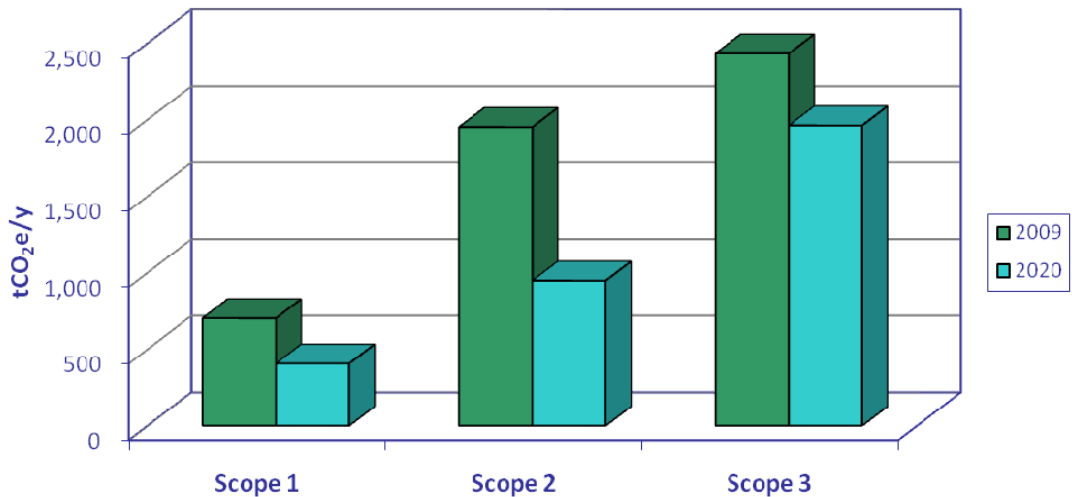


Figure 4.2: Emission Reduction by Scope

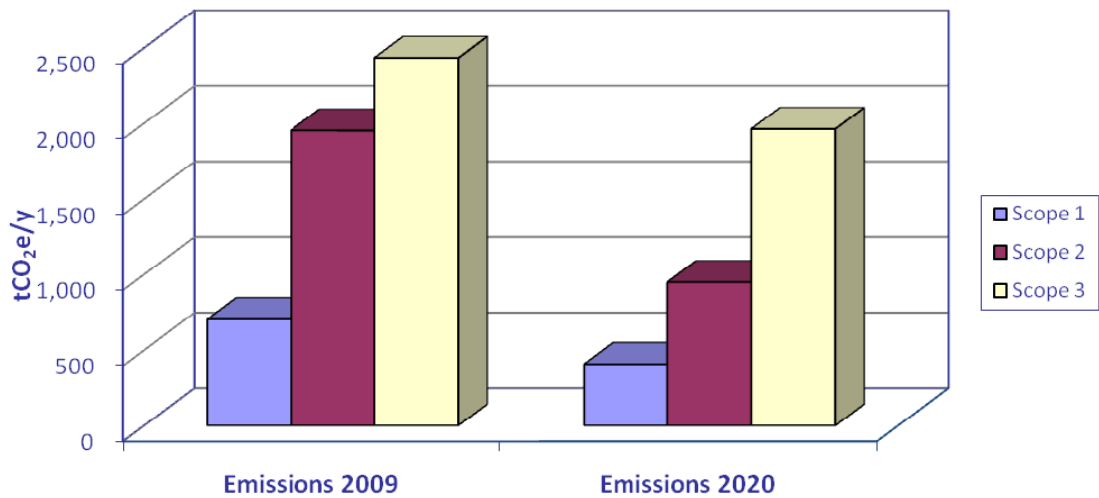


Figure 4.3: Emission Reduction by Year

4.8 OFFSETTING EMISSIONS

Carbon offsets can be used to purchase reductions in GHG emissions through off-site GHG mitigation projects.

The American College and University President's Climate Commitment (ACUPCC) consortia offers this definition: "...a carbon offset is a reduction or removal of carbon dioxide equivalent (CO₂e) greenhouse gas emissions that is used to counterbalance or compensate for ("offset") emissions from other activities".



In the same way as in a stock market transaction, carbon offsets can be described as a receipt indicating the details of a transaction. These offsets are typically “retired” or permanently removed from the market by the broker at the time of the purchase. When an offset has been retired from the marketplace, the purchaser can legitimately apply it to the reduction of the purchaser’s carbon footprint.

Offsets can play an important role in reducing emissions beyond what can technically be achieved on Campus. However, the intent for the Campus is to consider offset only once all the other sustainable options have been explored. Paying third parties to compensate for the University’s lack of emission reductions should therefore be viewed only as an ultimate alternative. The approach selected by the Campus Board is to pursue emission reductions through energy efficiency and conservation, investments in renewable energy generation or sustainability-oriented policies and, then, to purchase the required amount of carbon offsets to gain neutrality after all reasonable measures have been implemented.

Offsets sold in the voluntary carbon market are known as Verified (or Voluntary) Emissions Reductions (VERs), and a single offset typically represents one equivalent ton of CO₂ avoided emissions.

Generally, the cost of offsets tends to vary depending on both the assurance of a true GHG reduction, and other attributes of the project. For example, offsets resulting from avoided deforestation within a tropical rain forest will tend to cost more than offsets resulting from the destruction of methane from a coal mine, as offset purchasers may view multiple positive outcomes resulting from the first project. Offsets that are located near to the purchaser, keeping revenue within a local economy, may also command a higher price.

SEEU would likely choose to fund offset projects that are local, have a social benefit, and have a research and educational component, and thereby achieve multiple objectives. This plan proposes that SEEU identifies, where possible, local projects in line with its research and educational goals.

The selected approach for SEEU assumes that 10% of the emissions could be neutralized by purchasing quality carbon offsets from the open market.

The price of offsets is dynamic, fluctuating with supply/demand imbalances. The average price per ton of CO₂e is set at 5 €/tCO₂e. In this scenario, offsets would be purchased the first year and every year thereafter to maintain carbon reduction.

Table 4.12: Carbon Offset Potential

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Offset	508	2,540	-5 (cost)	-	-	1	10%

4.9 THE PILOT INITIATIVE

After the publication of the GHG inventory, a representative building was selected in order to create a pilot sustainable initiative, aimed at showing the campus commitment towards energy efficiency and renewable energies.



The pilot building, hosting the Institute for Environment and Health, presents several interventions aimed at energy production from renewable energy sources and at energy saving.

The building is aimed at being as much “self sustainable” as possible: this means to be independent from fossil fuels and external electricity purchase and to reduce dispersions and energy losses.

The following systems have been designed and/or installed:

- geothermal heat pump (groundwater system) to meet the heating and cooling demand;
- solar thermal plant (evacuated tubes system) for domestic hot water production;
- controlled mechanical ventilation system;
- solar shading solutions – blinds and trees;
- ventilated facades (designed only);
- solar photovoltaic plant for electricity production, meeting the energy demand for self consumption of the geothermal system;
- lamps replacement (designed only);
- automatic lighting management systems – domotic system and UPS (designed only);
- foundations insulation in order to reduce the dispersions to the ground in winter.

The pilot initiative does not include lamps replacement/lighting management system, ventilated facades and UPS. Such solutions have been designed, but their realization is more likely to be covered by other funding sources.

The installation of a geothermal heat pump system for heating and cooling is considered as a pillar. Together with this realization, the implementation of the other project activities will allow pursuing savings in energy, electricity and funds for the Campus, which have been calculated in terms of:

- primary energy: 65,185 kWh/y;
- tons of oil equivalent: 5.61 TOE/y;
- kWh of electricity for the user: 7,262 kWh/y;
- liters of fuel oil: 4,721 l/y;
- tCO₂ emission reduction: 20,644 tCO₂/y;
- economic savings: 3,811 €/y.

The following Figure 4.4: shows the designed configuration of the pilot building after the implementation of the sustainable measures for increase of energy efficiency and generation of renewable energy.

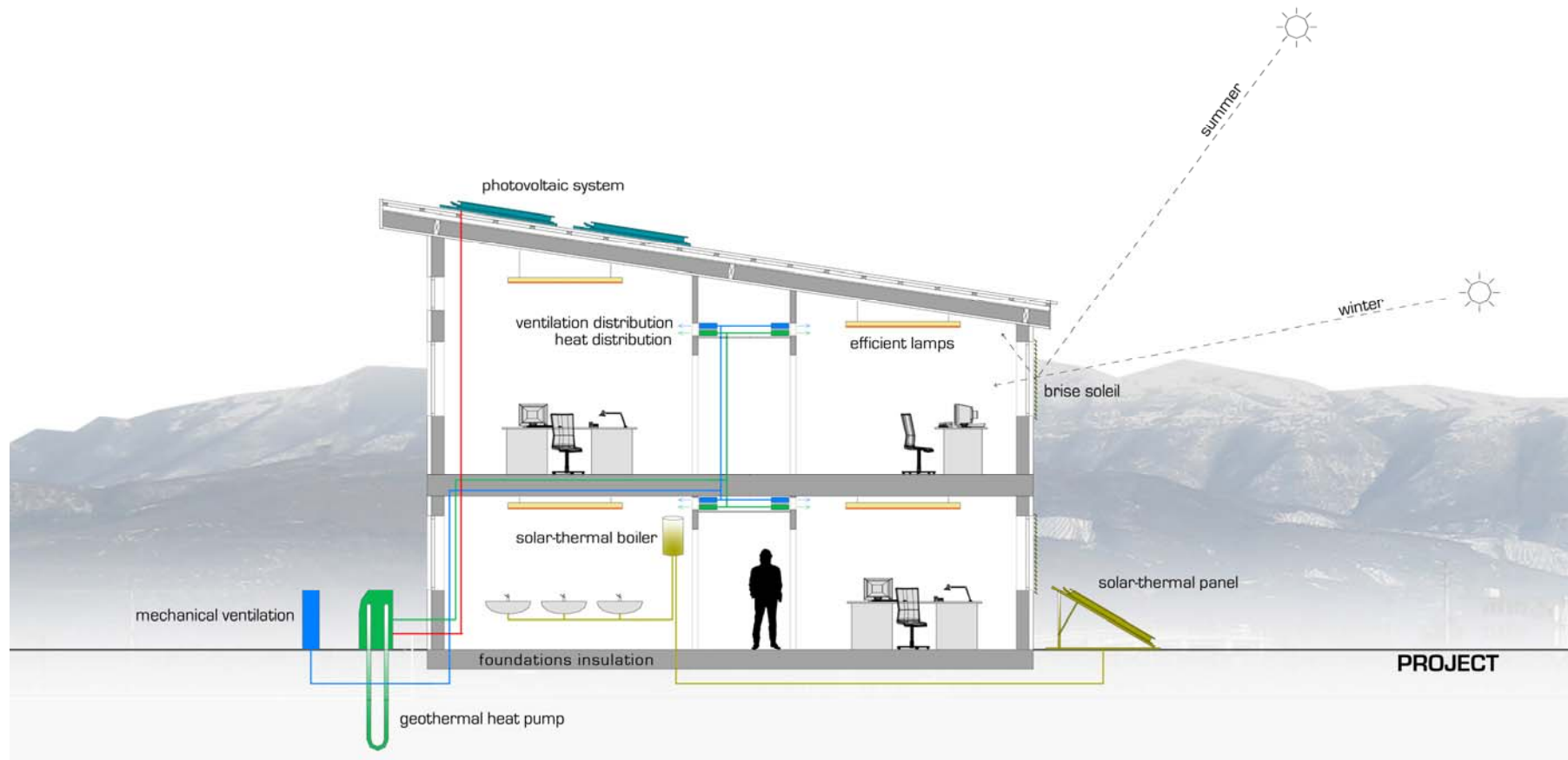


Figure 4.4: Sustainable Measures on the Pilot Building

5 PROJECT EVALUATION AND RANKING



Projects and policies have been ranked according to the mechanism illustrated in Section 4.1.1: the University management has set an interim reduction target by 2020 of 30% of the current GHG emissions.

The University also aims at pursuing 100% emission reduction by 2030, i.e. carbon neutrality, as a challenging ambition.

As already mentioned, the initial choice will fall on zero or low cost projects. Of course, the emission reduction targets can be only partially solved by means of these low cost projects. After this initial phase, therefore, priority will be given to actions with the best ratio between the economic viability and the emission reduction potential, reflecting the University's preference for mechanisms that guarantee a quick payback.

Finally, the last mitigation strategy is represented by the purchase of carbon offsets. Once all the sustainable mechanisms have been exhausted, the University can meet all additional emissions reductions through the purchase of carbon offsets.

Each action could be implemented according to the time frame presented in Table 5.1, where short-, mid- and long-term strategies are detailed.

The upper part of the table presents the trend of generated emissions according to the Baseline scenario (as per the GHG Inventory trend) and to the CAP scenario over the period 2009-2020.

In the central part of the table, the time frame for the implementation of the outlined actions is presented: the phasing of activities is indicated by the blue cells, where the % indicates the related share of realization, since some investments (and their benefits) are meant to be spread over some years.

The table also displays, in the lower part, the cumulative % of achieved emission reduction and the annual and cumulative investment for the CAP implementation.



Table 5.1: CAP Implementation Progress – Time Schedule

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline (tCO ₂ e)	5,085	5,230	5,191	5,242	5,295	5,348	5,401	5,455	5,510	5,565	5,621	5,677
CAP – subtotal (tCO ₂ e)	5,085	5,230	5,191	5,016	4,705	4,389	4,206	4,135	4,000	3,864	3,755	3,646
CAP implemented (tCO ₂ e)	5,085	5,230	5,016	4,705	4,389	4,206	4,135	4,000	3,864	3,755	3,646	3,420
Solar Thermal							33%	33%	34%			
Foundations Insulation								50%	50%			
Selective Collection						100%						
Lamps Replacement			50%	50%								
Photovoltaic				25%	25%					20%	20%	10%
SEEU Shuttles			50%	50%								
Videoconference			50%	50%								
Behavior Modification			50%	50%								
Carpool/Public Transport Policy					50%	50%						
Fuel Switch												100%
Cumulative Reduction			3%	10%	16%	19%	21%	23%	26%	28%	30%	35%
Annual Implementation Cost (€y)			157,685	720,185	812,500	258,000	125,237	850,237	854,032	450,000	450,000	395,000
Cumulative Implementation Cost (€)			157,685	877,870	1,690,370	1,948,370	2,073,607	2,923,845	3,777,877	4,227,877	4,677,877	5,072,877

Note: the blue cells with % indicate the annual share of implementation of the related intervention.



In the following sections, short-, mid- and long-term actions are analyzed in more detail.

5.1 SHORT-TERM ACTIONS

This plan identifies as short-term actions the projects to be implemented by 2015.

Low cost projects will be implemented first, together with the more urgent actions, due to the fact that the related service is currently missing, such as the selective waste collection or a solution for students' collective transport.

The only exception in this ranking is constituted by photovoltaic. An initial share of 50% of the total capacity is foreseen in the short-term scenario due to the very high potential of emission reductions and to the strong commitment of the University to invest in renewable energies.

Therefore, the actions foreseen in the short-term scenario are:

- selective collection;
- lamps replacement;
- photovoltaic;
- SEEU shuttles;
- videoconferences;
- behavior modification policy;
- carpool/public transport policy.

Investments will be carried out spread over some years, according to the time schedule presented in Table 5.1.

5.2 MID-TERM ACTIONS

Mid-term actions will be implemented in the period 2015-2017. In this time span, the plan foresees actions with considerable benefits but high implementation costs, such as foundation insulation or interventions with energy production from renewable sources having low or negative marginal cost of reduction, i.e.: solar thermal systems.

To summarize, the actions foreseen in the mid-term scenario are:

- foundations insulation;
- solar thermal.

As per short-term scenario, investments will be carried out over some years, according to the time schedule presented in Table 5.1; in particular solar thermal will be split into three sub-parts and foundations insulation into two.

5.3 LONG-TERM ACTIONS

Technological barriers currently prevent from implementing fuel switch interventions. Both a strong supply chain for biomass and a network for methane supply are missing in the region, therefore the fuel switch has been designed as long-term action.



In the same scenario, also the completion of the solar photovoltaic investment has been set, split into three sub-parts.

The deadline for the realization of this CAP has been set at year 2020. If the plan implementation will be respected, by 2020 the University will be able to reduce its 2009 carbon footprint of 34.8%. The investment costs required by these actions have been estimated equal to more than 5 million €

The following Figure 5.1 shows the comparison between the annual emissions in the baseline scenario, as per the figures from the GHG inventory, and the forecasts on emission trend after the implementation of the CAP strategies. Year by year a decrease in carbon emission will be registered, targeting the final goal in year 2020 which is estimated to be 34.8% of emission reduction. It must be noted that such value is not including the additional benefit deriving from the purchase of carbon offsets.

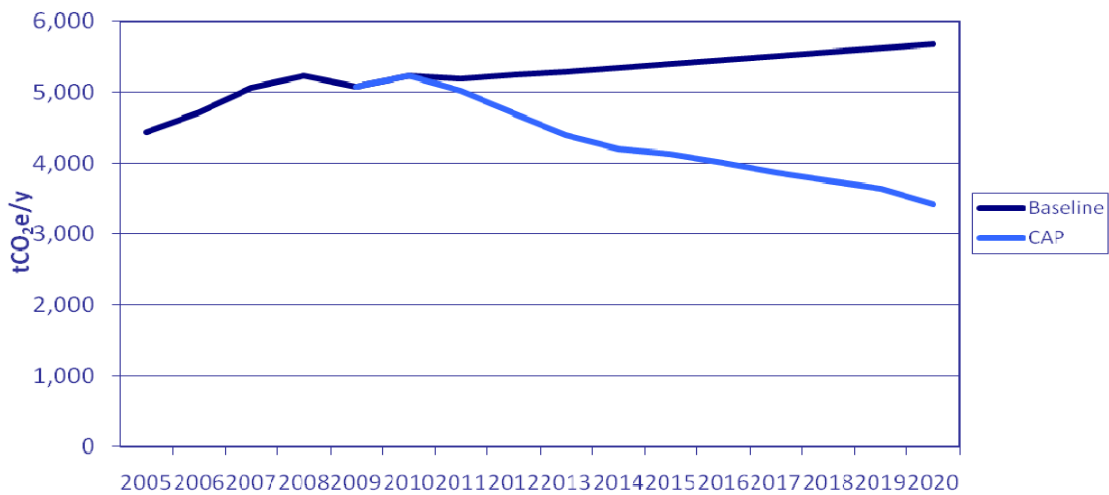


Figure 5.1: Achievable GHG Emission Reductions through CAP Implementation

6 ROLE OF EDUCATION AND RESEARCH



The University target is to become a leader in the sustainability field and the strategies included in this plan will help further reduce the Campus' environmental impacts; the University's commitment towards sustainability must be matched by its efforts to make its curriculum sustainable. Attention must be given to creating a learning environment that produces ecologically literate and socially responsible graduates, able to translate the lessons learnt at the University into concrete actions.

6.1 BACKGROUND / MISSION

SEEU's mission is to share knowledge with students and place it in service of community and society. Therefore, in line with both the institutional mission and the climate neutrality goal, this plan identifies actions to promote investments devoted to energy, environment and climate and to further integrate sustainability in teaching and learning. This will not directly result into reductions in GHG emissions, but the promotion of cultural and behavioral changes will help achieving the climate neutrality goal. At a wider extent, SEEU aims at becoming an excellent example of a Green Campus for the Region, a living example of sustainability where new ideas and strategies to mitigate climate change could be developed, tested, implemented. Ideally, the University itself can become a learning laboratory for the promotion of sustainability. It will be essential to underline that research and education become closely related to each other and placed in the larger regional and social context within which the University operates. SEEU goals in the field of sustainability can be summarized as follows:

- to introduce sustainability and climate change topics in the University curriculum;
- to make the Institute for Environment and Health a center of academic excellence for the University;
- to institute and/or to strengthen partnerships with other universities, creating internships and study programs on sustainability and climate change;
- to make sustainability and climate change prominent features of events and programs that attract off-campus participants (public lectures, extracurricular activities, workshops, etc.);
- to develop new funding streams to support the initiatives outlined in this CAP.



6.2 STRATEGIES

SEEU has the opportunity to be a catalyst for regional and national efforts to mitigate global climate change. Its visibility and reputation will rise by demonstrating climate leadership and helping reduce the region's GHG emissions.

The education strategies must focus on integrating sustainability in the curriculum so that all students have, at a minimum, a basic understanding of how to contribute to a sustainable society and those students interested in gaining deep knowledge of the issues are given the opportunities to do so. For students who want to pursue graduate studies and careers in sustainability, this plan recommends to develop new graduate degree programs in sustainability, along with increased support of student involvement in University research centers.

SEEU offers several courses with an environmental, sustainability, and/or global climate change component, although these topics do not fall under a formally established minor.

The Institute for Environment and Health issued in 2006 the "Strategic Plan 2006-2010". The document has four main goals:

- helping the Institute to clarify, focus and plan its development and prospects;
- providing a considered and logical framework within which the Institute can develop and pursue its strategies for achieving its goals over the forthcoming years;
- serving as a basis for discussion with third parties such as partner universities, funding agencies, the Government, relevant Ministries, research collaborators and employer groups;
- offering a benchmark against which actual performance can be measured and reviewed.

The Strategic Plan is structured according to 4 Strategic Goals:

1. Education: develop and organize program studies through multi disciplinary approach;
2. Implementing science-research programs and projects;
3. Increasing public awareness for developing health environment;
4. Building partnerships and cooperation with national and international institutions.

Moreover, confirming its commitment towards sustainability, SEEU completed its first GHG inventory in 2009. The inventory acted as a research project covering all sectors of the campus, including energy generation, electricity purchase, transportation, solid waste. Moreover, the GHG inventory also provided a meaningful tool for the University to rank its priorities and set the forthcoming actions to reduce its emissions. Following the completion of the Climate Action Plan, an updated GHG inventory will be completed with significant participation of faculty and students.

6.2.1 Current Situation: Master Studies, Conferences, Lectures, Workshops

SEEU is currently committed to disseminating know how and education on sustainability and environment preservation. The campus hosts, from time to time, conferences and lectures open to students and staff.



In the field of academic programs, MA Studies Institute for Environment and Health in frame of SEE University developed the Master Studies for “Management of Environment”. It was one of the first master programs in environmental sphere provided in Republic of Macedonia and it has been attractive for new graduated students. The program includes curriculum that fulfills Bologna and European standards. The first generation started this program in the winter semester of 2007.

6.2.2 New Courses in Sustainability and Climate Mitigation Planning

The creation of a dedicated course on sustainability and/or climate mitigation planning represents a strong opportunity for SEEU in view of the realization of the main sustainability goals. The course should be focused on interdisciplinary examination of climate change with a program oriented at educating students in the relevant areas of the climate change issue: science, society implications, solutions. This will provide background and skills for students, developing a skilled labor pool for implementing GHG mitigation strategies on campus and for addressing the growing green economy.

6.2.3 Climate Change Seminars/Events

SEEU will develop seminars and workshops devoted to sustainability and global climate change. Hosting large, public sustainability-themed educational events is an excellent mechanism to engage the community and promote sustainability. Events may range from small internal workshops to large celebrations where to showcase the recent year’s sustainability accomplishments and educate the audience. In addition to project-oriented off-campus volunteer efforts, SEEU will be engaged in creating collaboration with local schools for Climate Education to raise climate awareness.

6.2.4 Study Programs

As a long-term objective, SEEU aspires to become a Centre of Excellence on Energy and Environment for the whole Balkan region. Therefore, in parallel with CAP implementation and short term workshops, it is planned to set the basis for the implementation of programs for formal education. To this goal, general principles and specific technical contents of a new post graduate study on energy and environment will be jointly defined, where possible signing a dedicated agreement with an Italian University providing know-how on the relevant educational sectors.

The new formal educational program will be focused on environmental protection, sustainable development and climate change, from a multidisciplinary point of view. Legal, economic, social, scientific and engineering topics will be included in the comprehensive post graduate study, to be hopefully started within the academic year 2010-2011.

When the CAP process will be effectively implemented, SEEU will be a unique example in South Eastern Europe and, from the educational perspective, a research centre for renewable energies and carbon emission reduction could be established with the support of other Macedonian and/or Italian university institutions.



The goal of the future laboratory will be the implementation of research activities on innovative technologies for the promotion and development of renewable energy sources, with specific focus on solar, wind and geothermal. The role of laboratories and research centers for the study of energy engineering problems is essential.

6.3 COMMUNICATION

It is important to consolidate the web portal and to take advantages of the use of new media.

It is essential to simply and strongly communicate:

- the interim results in climate neutrality process;
- the progress in the CAP implementation;
- the opportunities to contribute;
- the scheduled on-campus initiatives to participate in the process;
- the put into operation of every new available tools to reduce the individual and overall emissions.

Communication can be via many media, although a central web presence is a priority. SEEU will develop a specific section on its website to host the climate neutrality campaign's web content. Other sites (newspapers, the internal gazette, etc.) may host contents. The site could also host real-time energy data, updates to the GHG inventory, and other relevant topics.

7 IMPLEMENTING THIS PLAN: CAP FINANCING



The priority actions identified in Section 4 have significant emission reduction potential, but they also imply an implementation cost to the campus.

This section analyzes how SEEU can increase its efforts toward GHG emissions reduction by addressing the technological and institutional constraints that hinder the University to implement the mitigation mechanisms.

7.1 IMPLEMENTATION: WHO IS RESPONSIBLE?

Achieving climate neutrality will involve a coordinated effort over many years. Students, faculty and staff efforts, meant both as individuals and as groups, will be needed in the process.

The key priorities for implementation identified in this plan need a strong managing organization. SEEU is entitled with the challenging responsibility to play the coordinating role. Roles and responsibilities for others are also outlined here.

Proper tracking mechanisms will enable accountability and help identify strengths and weaknesses. By establishing interim targets, strategies can be updated to reflect changing realities.

Several entities can be identified as focal points among the overall Campus structure:

- University management;
- University facilities;
- Institute for Environment and Health;
- Faculties;
- Staff;
- Students.

There are no strict barriers among each group, so considerable overlapping among the roles can take place. To ensure an effective implementation of the strategy, a short-term priority is the definition of specific roles and relationships between these focal points.



7.2 BARRIERS TO IMPLEMENTATION

The primary goal of the CAP and the enclosed strategies is to draw a path for SEEU to pursue GHG emissions reductions.

However, the process is not free from significant barriers, mainly institutional but also technological. Such barriers currently constrain the University from achieving immediate environmental benefits, as figured out in the Climate Action Plan.

An important step of the analysis is the identification of temporary and stable barriers, so that the most appropriate strategy can be defined. Examples of temporary barriers are obsolete or missing regulations, diffidence against new technologies, and other obstacles which can be easily removed as soon as the new actions are implemented. Stable barriers, instead, are embedded in the institutional fabric and are difficult to overcome unless new regulations are introduced or a cultural shift happens. The strength of the stable barriers is more aggressive to a sustainable planning and would require stronger efforts and strategies to overcome them.

In general, the main barriers for CAP implementation, analyzed in details in the following sections, are related to:

- funds raising;
- GHG information systems and CAP awareness;
- technological barriers.

7.2.1 Funding Issues

Funding issues often represent the most significant constraint to the implementation of mitigation mechanisms. A main issue to overcome is the state budget allocation system, which sometimes hinders the University's efforts to invest in energy efficiency projects. According to the definition of Section 7.2, the state funding allocation system is therefore a stable barrier limiting the implementation of energy efficiency projects. Such projects, requiring high upfront investments for long-term cost savings, are unlikely to be ranked first when setting the priorities due to their high implementation costs.

Strategies to overcome funding obstacles should rely on external sources of equity. Sustainable projects typically result in monetary savings and provide environmental benefits over the short and long haul. However, even financially attractive projects with large upfront costs will remain unfunded unless additional sources of equity are raised. SEEU could assess the following options:

- Energy Services Companies (ESCO) – ESCOs are companies that provide the up-front capital for projects and are paid out of the energy savings associated with the project. The details of the energy savings sharing between the ESCO and the client are specified through an energy savings performance contract (ESPC) or a shared-savings agreement (Energy/Utility Glossary, 2011);
- external lenders: SEEU could be eligible for funding in the form of low-interest loans from external sources;
- student fees, as outlined in details in Section 7.3.



7.2.2 GHG Information Management Constraints

Until the first GHG Inventory issue, the University did not take records of its generated emissions by means of an integrated system. Data collection from some impacting sources (e.g.: campus fleet, commuting, air travel, waste management) is still based on manual records or at least on non-centralized management system.

Due to the complicated access to Campus GHG emissions data, it is currently difficult to evaluate whether the implemented actions are getting to considerable results or not. For this reason the management of the University could be discouraged from including GHG considerations into its strategies if the data are difficult to find. The lack of an integrated energy information system is a temporary barrier because creating such a system requires a short term commitment.

Good management, analysis and communication of records of GHG emission sources are required for all the relevant facilities.

Possible strategies to overcome information obstacles are:

- to strengthen the formal Office/Working Group dedicated to Sustainability (i.e.: the Technical Working Group from the Institute for Environment and Health) – the spread of a culture of sustainability passes through the creation of an official department or office to coordinate sustainability efforts on campus, divulgate information and results, manage data collection and processing;
- to invest in a new GHG Management System that manages and analyzes greenhouse gas data along with energy indicators.

7.2.3 Technological Barriers

The realization of new sustainable systems carries on the need of introducing new technologies on the market and in the background of the people who day by day have to deal with them. This could raise technological barriers along with the intrinsic energy factors:

- lack of widespread technology at local level;
- lack of retail and spare parts stores in the local market;
- lack of background and expertise for installation and maintenance of some specific technologies;
- higher costs for green systems against traditional solutions;
- lack of renewable energy sources potential in some fields (e.g.: solar radiation, wind, aquifer).

7.2.4 Other Barriers

Other than the technological barriers, the following obstacles could prevent the implementation of sustainable measures:

- unattractive or missing incentives scheme;
- lack of regulations and policies;
- difficulties for grid connection of renewable energy plants.



7.3 CREATION OF A GREEN FUND

Many Universities decided to introduce fees on students to finance environment-oriented projects. Setting up a student-fee-based revolving fund is proving to be a very popular financial resource on university campuses. With enough students, faculty, and staff support, fee programs can raise significant amounts of money to fund GHG mitigation measures and sustainability programs. The principle is to charge each student with a fixed fee, to use to set up a fund for mitigation projects on campus.

Students usually have to vote on the approval of such mechanism, i.e. to “tax” themselves to support GHG reduction initiatives; on the other hand, the campus administration usually commits itself to support students initiatives in the sustainability field, investing revenues or savings generated by the projects. Portions of the fund can support, for example, education initiatives, student aid and internships. Students will be involved in the sustainable mechanism: an application process can be set up for students to submit energy savings initiatives to the committee.

A preliminary mechanism suggestion is based on the introduction of a €5 fee per semester per student to finance student, faculty, and staff sustainability initiatives.

The fee can be thought according to two mechanisms, both on mandatory basis:

- to apply the fee, additional to the annual registration fee;
- to save that amount of money from the registration fee and to destine it to sustainable development activities.

Based on this assumption and considering the University population, it is estimated that approximately € 50,000 per year could be collected annually to fund such initiatives related to GHG emissions reduction and sustainability education.

No similar mechanism currently exists at SEEU; therefore the initiative has to be properly defined, in order to establish the mandatory or voluntary nature of such initiative, the way of levying, the existing programs to invest on, the fee amount and frequency, etc.

8 TRACKING PROGRESS



An update to the campus GHG Inventory shall be periodically carried out, e.g.: on two- or five-year basis. The inventory will assist the Campus in monitoring its progress including total campus energy consumption, total GHG emissions, trends, achieved results and GHG emissions per capita.

The next Campus GHG inventory will take a picture of SEEU after FY 2009. In addition to the emissions sources included in the first inventory (FY 2005-2009), the updated report will also include discussion of campus sustainable actions and their contribution to carbon mitigation, displaying the interim results achieved according to the first steps of sustainable implementation, as per the strategies outlined in this plan.

The results will be carefully analyzed and new data collection and reporting protocols will make the data more accurate over time.

Also, as data collection methods are refined, it is possible that additional aspects of the Campus carbon footprint may be included such as emissions from procured products and services, such as food service, building materials, office supplies, etc. Methodologies for this accounting are still at an early stage but these emissions (or their avoidance) may be included in future inventories.

This plan itself needs to be tracked periodically; updates shall be published accordingly. As technology develops, energy costs rise, and other factors change, it is anticipated that there will be changes in the campus projected emissions and targets for reduction. Besides, monitoring of the progress of strategies implementation will help defining new goals.

Monitoring is also needed at the single-building level: that would help the campus decision-makers understand the level of performance of the systems in terms of resource usage.

9 CONCLUSIONS



This living document is an ongoing, thorough effort to drive the SEEU Campus towards carbon neutrality and sustainability.

Institutions such as Universities, as key actors in the higher-education system in the society, are gradually committing themselves to address climate change. SEEU is strategically located to play a leadership role for universities in the National and South Eastern Europe context. In addition to this leading-role opportunity, the analysis carried out indicates that significant cost savings can be found in reducing the University's GHG emissions. This assessment indicates that SEEU is missing a significant energy and cost savings opportunity due to several barriers to implementing sustainable projects.

The Climate Action Plan originated from the realization of a GHG inventory. The inventory quantified where and how many emissions are generated within the spatial boundaries of the campus. SEEU issued its GHG inventory on July 2010 (D'Appolonia/SEEU, 2010), reporting emissions for the fiscal years 2005-2009 and with specific reference to fiscal year 2009.

A set of key sustainable actions has been outlined in this CAP:

- institution of policies on behavior modification and transportation;
- investment in energy efficiency measures such as fuel switch, foundations insulation, lamps replacement, shading solutions;
- production of energy from renewable sources such as biomass, solar (thermal and photovoltaic), geothermal;
- set up of new transport solutions;
- introduction of selective waste collection.

Through the implementation of the initiatives described in this CAP, related to stationary, mobile, and behavioral fields, SEEU can reach the challenging target of 34.8% emission reduction by 2020, assuming that funding sources are found and unforeseen events do not compromise or delay the planned initiatives. Additional to the sustainable actions contribution is the role of carbon offset, to be chosen only once all the other sustainable options have been explored. This is in line and even superior to the University interim target, set at 30% by fiscal year 2020.

The role of the University as an education-oriented institution is prominent. SEEU will have to enhance the current efforts in the field of sustainability, strengthening the organization of workshops and lectures, creating a dedicated academic course, instituting study programs and partnerships with other European universities.

Together with the educational responsibilities, the University, through the Institute for Environment and Health, will monitor and report on progress as well as recommend future updates and revisions to the Plan.

CONCLUSIONS



To implement this Climate Action Plan, the strategies identified will need to be prioritized, funded, and assigned for further action. A specific internal funding mechanism has been identified, the Green Fund: a fixed annual fee charged to each student will be used to set up a fund for mitigation projects on Campus.

A key challenge and focus in moving towards the climate neutrality will be to identify new funding sources and synergies between Campus operations and academic/research initiatives, which would support educators in using the built environment as the context for sustainability learning and research.

The CAP actual implementation will be periodically monitored and updates will be published accordingly. As technology develops, energy costs rise, and other factors change, changes are expected in the Campus projected emissions and targets for reduction.



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**APPENDIX A
GHG INVENTORY RESULTS**



Fiscal Year	Scope 1							Scope 2		Scope 3						Total Scope 1	Total Scope 2	Total Scope 3	Total Emissions
	Co-gen Electricity	Co-gen Steam	Other On-Campus Stationary	Direct Transportation	Electric Fleet	Refrigerants & Chemicals	Agriculture	Purchased Electricity	Purchased Steam / Chilled Water	Faculty / Staff Commuting	Student Commuting	Directly Financed Air Travel	Other Directly Financed Travel	Study Abroad Air Travel	Solid Waste				
	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y	tCO ₂ e/y				
2005	-	-	534.4	35.9	-	37.6	-	1,592.3	-	339.5	1,586.0	8.8	-	-	298.7	607.8	1,592.3	2,232.9	4,433.1
2006	-	-	565.8	35.9	-	37.6	-	1,605.5	-	352.5	1,781.8	7.0	-	-	336.3	639.3	1,605.5	2,477.5	4,722.3
2007	-	-	597.2	35.9	-	37.6	-	1,816.4	-	346.8	1,866.7	8.8	-	-	353.1	670.7	1,816.4	2,575.4	5,062.5
2008	-	-	628.7	35.9	-	37.6	-	1,950.2	-	338.5	1,873.2	7.9	-	-	357.1	702.1	1,950.2	2,576.7	5,229.1
2009	-	-	628.7	35.9	-	37.6	-	1,950.2	-	333.2	1,758.1	7.9	-	-	332.9	702.1	1,950.2	2,432.1	5,084.5
2010	-	-	628.7	35.9	-	37.6	-	2,092.0	-	344.1	1,746.8	7.9	-	-	336.5	702.1	2,092.0	2,435.3	5,229.5



**APPENDIX B
OUTLINED STRATEGIES IN THE CAP**

Appendix B - GHG Reduction Strategies – Action #1

Category	Energy Efficiency
Action	Behavior Modification – Policy
Action Description	The action targets the most common and most wasteful behaviours of students who live on campus and of people who use the campus services - leaving computers on when not in use, leaving the heat and/or air conditioning on when leaving a room, taking excessively long showers. The objective is to reduce the energy demand of 1%.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Behavior Modification	19.5	-	32 (saving)	15,690	-	25	0.4%

Fact and Assumptions

- Assumed Energy demand reduction target: 1%
- Annual Electricity Consumption: 2,040,000 kWh/y
- Assumed price of electricity: 0.066 €/kWh
- Emission factor for electricity: 0.956 tCO₂e/MWh
- Assumed zero-cost for policy implementation
- Project lifetime: 25 years

Quantitative Evaluation

Energy Calculation

Energy Demand Reduction = Energy Demand Reduction Target * Annual Electricity Consumption = 20,400 kWh/y

€Calculation

NPV = (10,200 kWh/y * 0.066 €/kWh) * NPV factor = 15,690 €

Where NPV factor = 11.65

GHG Emission Reduction Calculation

Emission Reduction = Energy Savings/y * electricity emission factor = 19.5 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #2

Category	Transportation
Action	Carpool/Public Transport – Policy
Action Description	Transportation is responsible for about 35% of total campus GHG emissions. Carpooling could be one way to significantly reduce them. The proposed action would decrease the single-occupancy vehicle utilization of 10%; in addition to carpooling, the realization of a partnership with the Municipality for the introduction of an effective public transport system can lead to 5% reduction more. The two interventions would translate into an annual GHG reduction of 360 tCO ₂ e.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Carpool	360	500,000	191 (saving)	2,450,000	2	25	7.1%

Fact and Assumptions

- Current share of single-occupancy vehicle: 40%
- Current share of carpooling: 50% (2 people per car)
- Assumed reduction target of single-occupancy vehicle utilization: 15%
- Assumed bus utilization target: 25%
- Current gasoline consumption: 1,042,018 l/y
- Calculated new fuel consumption – car: 721,400 l/y
- Calculated new fuel consumption – bus: 51,700 l/y
- Calculated new traveled distance – car: 6,780,000 km/y
- Calculated new traveled distance – bus: 147,000 km/y
- Assumed bus fuel consumption: 0.35 l/km
- Emission factor for car: 0.17 tCO₂e/km
- Emission factor for bus: 1.035 kgCO₂e/km
- Gasoline price: 0.94 €/l
- Assumed cost for public transport partnership implementation: 500,000 €
- Project lifetime: 25 years

Quantitative Evaluation

Energy Calculation

Gasoline Consumption Reduction = 1,042,018 - 721,400 – 51,700 l/y = 268,920 l/y

€Calculation

Annual Saving = Fuel Consumption Reduction * Fuel Price = 252,700 €/y

NPV = -500,000+ (268,920 l/y * 0.94 €/l) * NPV factor = 2,450,000 €

Where NPV factor = 11.65

GHG Emission Reduction Calculation

Emission Reduction Carpooling = new traveled distance * car emission factor = 512 tCO₂e/y

Generated Emissions – Bus = bus traveled distance * bus emission factor = 152 tCO₂e/y

Net Emission Reduction = Emission Reduction Carpooling – Generated Emissions = 360 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #3

Category	Energy Efficiency
Action	Fuel Switch
Action Description	The proposed action would retrofit the existing heating systems in order to switch from Mazut-based boilers to LPG-based boilers. This would lead to a GHG reduction due to LPG lower emission factor.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Fuel Switch	171	170,000	90 (saving)	384,000	4	25	3.4%

Fact and Assumptions

- Yearly thermal demand: 2,004,000 kWh/y
- Current Consumption of Fuel Oil: 200,000 l/y
- Heating value Fuel Oil: 10.4 kWh/l
- Heating value LPG: 13 kWh/kg
- Emission factor for fuel oil: 0.278 tCO₂e/MWh
- Emission Factor LPG: 0.227 kgCO₂/kWh
- Mazut unit cost: 0.70 €/l
- LPG unit cost: 0.30 €/l
- Mazut annual expense: 140,000 €/y
- Total Campus emissions: 5,084.50 tCO₂e/y
- Energy efficiency increase due to efficient boiler: 4%

Quantitative Evaluation

Energy Calculation

LPG consumption = Yearly thermal demand/LPG heating value = 156,722 kg/y

€Calculation

Annual LPG expense = LPG consumption * LPG unit cost = 92,466 €/y

Yearly Economic Saving Potential = Fuel Oil annual expense – LPG annual expense = 47,534 €/y

NPV = -170,000 € + 47,534 * NPV factor = 384,000 €

Where NPV factor = 11.65

GHG Emission Reduction Calculation

Net Emission Reduction = Fuel Oil emissions – LPG emissions = Fuel Oil consumption * Fuel Oil emission factor – LPG consumption * LPG emission factor = 171 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #4

Category	Energy Efficiency
Action	Foundations Insulation
Action Description	Regarding the campus, most of the existing structures have good insulation as per the walls and the roof. Insulation on the ground level represents the weakest part of these structures.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Foundations Insulation	125	1,450,000	-359 (cost)	-1,124,000	36	25	2.5%

Fact and Assumptions

- Surface of the intervention: 29,000 m²
- Type of insulating layer: Styrodur CS 5000
- Assumed cost of insulating layer and civil works: 50 €/m²
- Annual Fuel consumption: 200,000 l/y
- Assumed price of fuel oil: 0.7 €/l
- Assumed % of energy saving per intervention: 20% on total dispersions
- Emission factor for fuel oil: 0.278 tCO₂e/MWh
- Project lifetime: 25 years

Quantitative Evaluation

Energy Calculation

Fuel savings in winter regime = annual fuel consumption * % of savings in winter regime = 40,000 l/y

€Calculation

NPV = -1,450,000 € + (40,000 l/y * 0.7 €/l) * NPV factor = -1,124,000 €

Where NPV factor = 11.65

GHG Emission Reduction Calculation

Emission Reduction = Energy Savings/y * emission factor = 125 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #5

Category	Energy Efficiency
Action	Lamps Replacement
Action Description	Regarding the campus, the existing lighting system for alleys and interiors is constituted by fluorescent lamps and a mixture of non-energy efficient ones. A suggested action is the replacement of such fluorescent with CFL or LED efficient lamps on the external posts for space illumination and with energy-saving lamps in the internal spaces.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Lamps Replacement	221	150,370	4.9 (saving)	27,200	10	25	4.3%

Fact and Assumptions

- Type of new lamps
- Illuminated Surface: 29,000 m²
- Lamps performance: 1 lamp every 2.7 m²
- Saving per lamp: 21 kWh/y
- Assumed price of new lamps: 4 €/pz
- Assumed cost of auxiliary components: 10 €/pz
- Assumed price of electricity: 0.066 €/kWh
- Emission factor for electricity: 0.956 tCO₂e/MWh
- Project lifetime: 25 years

Quantitative Evaluation

Energy Calculation

Installed Rated Capacity = Surface / Lamps performance = 10,740 lamps

Electricity Saving = Rated Capacity * Saving per lamp = 230,870 kWh/y

€Calculation

NPV = -150,370 € + (230,870 kWh/y * 0.066 €/kWh) * NPV factor = 27,200 €

Where NPV factor = 11.65

GHG Emission Reduction Calculation

Emission Reduction = Energy Savings/y * emission factor = 221 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #6

Category	Renewable Energy
Action	Solar Water Heaters
Action Description	Current water heaters are electrical boilers. The high potential for solar applications against the high emissions from electrical systems, make the solar thermal applications for domestic hot water an attractive investment from the energy point of view.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Solar Water Heaters vs. Electrical Boilers	216.9	380,000	-37.8 (cost)	-205,000	25	25	4.3%

Fact and Assumptions

- Type of equipment, modules and boilers
- Gross and net installed surface: 506 m² (gross) – 450 m² (net)
- Assumed cost of the system: 750 €/m² (gross)
- Assumed price of electricity: 0.066 €/kWh
- Emission factor for electricity: 0.956 tCO₂e/MWh
- Project lifetime: 25 years

Quantitative Evaluation

Energy Calculation

Energy Production = 612,630 MJ/y

Equivalent Electricity Consumption with Electric Boiler = Energy Production / 3.6 = 226,900 kWh/y

€Calculation

NPV = -380,000 € + (226,900 kWh/y * 0.066 €/kWh) * NPV factor = -205,000 €

Where NPV factor = 11.65

GHG Emission Reduction Calculation

Emission Reduction = Energy Savings/y * electricity emission factor = 216.9 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #7

Category	Renewable Energy
Action	Photovoltaic Power Plant
Action Description	The campus needs large amounts of electricity for internal uses. The current source of electricity is the purchase from the grid. Electricity production from renewable energy sources can help reducing the dependence from external sources. Solar photovoltaic has high potential in terms of sun radiation and spaces availability.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
PV system	546	2,250,000	52.6 (saving)	717,700	8.8	25	10.7%

Fact and Assumptions

- Type of equipment, modules and inverters
- Rated capacity of the system: 500 kWp
- Assumed cost of the system: 4,500 €/kWp
- Assumed cost of auxiliary components
- Assumed price of electricity: 0.066 €/kWh
- Assumed incentive for electricity: 0.38 €/kWh
- Emission factor for electricity: 0.956 tCO₂e/MWh
- Project lifetime: 25 years

Quantitative Evaluation

Energy Calculation

Energy Production = equivalent hours of sun radiation per year * plant's rated capacity = 1,142*500 = 571,000 kWh/y

€Calculation

NPV = -2,250,000 € + (571,000 kWh/y * (0.066 €/kWh + 0.38)) * NPV factor = 717,700 €
Where NPV factor = 11.65

GHG Emission Reduction Calculation

Emission Reduction = Energy Savings/y * electricity emission factor = 546 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #8

Category	Transportation
Action	Use of Videoconferences
Action Description	This strategy refers to the replacement of air flights and car trips with videoconferences and remote communications (e.g.: interviews, consultations) where possible.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Video-conferences	33	15,000	189 (saving)	157,500	1	25	0.7%

Fact and Assumptions

- Assumed Realization of a new Conference Room
- Assumed Conference Room Surface
- Assumed Realization Cost for Conference Room: 15,000 €
- Yearly traveled kilometers – air: 43,000 km/y
- Yearly gasoline consumption: 7,000 l/y
- Yearly diesel consumption: 7,000 l/y
- Gasoline emission factor: 2.29 kgCO₂e/l
- Diesel emission factor: 2.68 kgCO₂e/l
- Air travel emission factor: 0.18 kgCO₂e/cap/km
- Assumed target of saving in air flights: 50%
- Assumed target of saving in road trips: 40%
- Gasoline price: 0.94 €/l
- Diesel price: 0.89 €/l
- Assumed air flight ticket cost: 0.45 €/km
- Project lifetime: 25 years

Quantitative Evaluation

Energy Calculation

Fuel Saving = target of saving in road trips * annual fuel consumption = 2,800 l/y gasoline + 2,800 l/y diesel

Flights Saving = target of savings in air flights * yearly traveled km = 21,500 km/y

€Calculation

Yearly Economic Saving Potential = Gasoline Savings* Gasoline Price + Diesel Savings * Diesel Price + Air Flight Cost * traveled km = 14,800 €/y

NPV = -15,000 €* 14,800 * NPV factor = 157,500 €

Where NPV factor = 11.65

GHG Emission Reduction Calculation

Gasoline Emission Reduction = Gasoline Savings * Gasoline Emission Factor = 6.4 tCO₂e/y

Diesel Emission Reduction = Diesel Savings * Diesel Emission Factor = 7.5 tCO₂e/y

Flights Emission Reduction = Flights Savings * Air Travel Emission Factor = 19.4 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #9

Category	Transportation
Action	SEEU Shuttles
Action Description	SEEU can directly contribute to the total campus GHG emissions by putting in place a shuttle service that would keep the students from using their own cars. Depending on the frequency of the service, this action could lead to a significant GHG reduction.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
SEEU Shuttles	41.77	50,000	36.05 (saving)	131,236	3.53	25	0.7%

Fact and Assumptions

- Number of commuting students in FY 2009: 5,285
- Assumed cost of shuttle buses: 25,000 €each
- Assumed extra urban shuttle capacity: 20 seats
- Assumed urban shuttle capacity: 40 people
- Number of extra urban shuttles: 2
- Number of urban shuttles: 1
- Assumed number of urban and extra-urban trips per day: 4
- Number of trips to SEEU: 3 days per week, 38 weeks per year = 114 trips/y
- Average trip Tetovo – SEEU: 5 km
- Average trip Tetovo – Skopje: 25 km
- Assumed Shuttle electricity consumption for battery charge: 22,000 kWh/y
- Emission factor for electricity: 0.956 tCO₂e/MWh
- Gasoline emission factor: 2.29 kgCO₂e/l
- Gasoline price: 0.94 €/l
- Diesel price: 0.89 €/l
- Project lifetime: 25 years

Quantitative Evaluation

Energy Calculation

Traveled km saving = single-occupancy vehicles km traveled in Tetovo-SEEU route and Skopje-SEEU route equivalent to new shuttle bus trips = 4,800 km/day = 547,200 km/y

Fuel saving = yearly km saving / unit fuel consumption (13 km/l) = 42,000 l/y

€Calculation

Yearly Economic Saving Potential = Fuel Savings* Fuel Price – Electrical Consumption * Electricity Cost = 38,100 €/y

NPV = -150,000 €* 38,100 * NPV factor = 157,000 €

Where NPV factor = 11.65

GHG Emission Reduction Calculation

Generated emissions for battery charge = kWh/y * Electricity Emission Factor = 20.9 tCO₂e/y

Gross Emission Reduction = Fuel Savings * Gasoline Emission Factor = 96.4 tCO₂e/y

Net Emission Reduction = Gross Emission Reduction – Generated Emissions = 75.5 tCO₂e/y

Appendix B - GHG Reduction Strategies – Action #10

Category	Waste Management
Action	Selective Collection
Action Description	The proposed action would place 4 containers (paper, plastic, glass, unselected waste) in each of the 20 points of waste collection that are already present on campus. Assuming a cost of €100 for each bin, it has been estimated a capital cost of €8,000. Since recycled material has no market potential in Macedonia, economic benefits equal zero.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Selective Collection	2.79	50,000	-115 (saving)	-8,000	n/a	25	0.05%

Fact and Assumptions

- Number and Capacity of new containers: 80, capacity 240÷360 l
- Assumed price of new containers: 100 €/pz
- Emission factors for recycled materials:
 - paper: -177 kgCO₂e/t
 - plastic: -41 kgCO₂e/t
 - glass: -30 kgCO₂e/t
- Assumed waste composition:
 - paper: 12%
 - plastic: 10%
 - glass: 4%
 - organic: 26%
 - other: 48%
- Assumed recycled share on the total disposal: 30% of paper, 20% of plastic, 20% of glass
- Project lifetime: 25 years

Quantitative Evaluation

€Calculation

NPV = upfront cost = - 8,000 €

GHG Emission Reduction Calculation

Emission Reduction = Σ (Waste Amount * Composition * emission factor) = 2.79 tCO₂e

Appendix B - GHG Reduction Strategies – Action #11

Category	Multi Task
Action	Carbon Offset
Action Description	Carbon offset represents a reduction in emissions somewhere else to balance out the emissions you cannot reduce. The accepted approach to carbon emissions is that emissions should be saved where possible and offset where they cannot be saved. This action proposes that SEEU further reduces its carbon footprint by buying carbon offsets, and specifically Voluntary Emission Reduction (VERs). It is noted that carbon offsets represent the only way to get SEEU carbon footprint to zero in the short term.

Action	Potential Annual GHG Reduction (tCO ₂ e/y)	Capital Cost (€)	Marginal Cost of Reduction (€/tCO ₂ e)	Net Present Value (€)	Payback time (years)	Project Lifetime (years)	Contribution to Overall GHG reduction
Offset	508	2,540	-5 (cost)	-	-	1	10%

Fact and Assumptions

- Assumed Yearly Share of Offset Emissions: 10%
- Offset Unit Cost: 5.00 €/tCO₂e
- Project lifetime: 1 year

Quantitative Evaluation

€Calculation

Total Capital Cost = Offset Unit Cost * Offset Amount = 2,542 €

GHG Emission Reduction Calculation

Offset Amount = % to Offset * Total GHG Emissions = 508 tCO₂e/y



Climate Action Plan Realized by:

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The South East European University has committed itself to reduce its greenhouse gas emissions and serve as the University country leader in the campaign to fight the climate change.

This Climate Action Plan is the roadmap to get SEEU to the goals of climate protection, defining carbon footprint, identifying priority actions and applicable technologies, milestones to measure progress and target dates, raising funding opportunities.

The SEEU Climate Action Plan is a 10-year strategic plan for how the campus will reduce its carbon emission through short, medium and long term targets. Its goal is to set up and implement specific actions for the reduction of the GHG emissions within the SEEU campus.

The project, a donation of the Italian Ministry for the Environment, Land and Sea, was developed by the joint team of experts constituted by D'Appolonia and SEEU Working Group, within the framework of the Italy-Macedonia Cooperation in the field of Environment and Sustainable Development.

