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D'APPOLONIA

REALIZATION OF A LOW EMISSION UNIVERSITY CAMPUS THROUGH THE IMPLEMENTATION OF A CLIMATE ACTION PLAN (CAP)

PROPOSAL



**SOUTH EAST EUROPEAN UNIVERSITY
TETOVO, REPUBLIC OF MACEDONIA**

May 2009

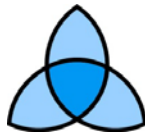


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1 INTRODUCTION

Within the last few years, following the high level commitments on climate change, several university campus have started planning to reduce their net emissions, in order to manage carbon and energy more efficiently. The most reliable long-term strategy to effectively realize a low emission campus is integrated, comprehensive planning for emission reduction and the alignment of the climate action plan with other campus plans, especially the master plan and the strategic plan.

Scope of this document is to present a proposal for introducing high energy efficiency measures and renewable energy plants in the South East European University (SEEU) in Tetovo, with the purpose of realizing a low emission campus through the implementation of a Climate Action Plan (CAP). CAP can be a roadmap to get SEEU to the goals of climate protection, defining a carbon footprint, identifying priority actions, milestones to measure progress and target dates, raising funding opportunities.

The SEEU is a modern university campus in Tetovo, Macedonia. Its mission is to pursue excellence in teaching and research and to be opened to all on the basis of equity and merit regardless of ethnicity, also actively seeking cooperation with other universities, both in the Republic of Macedonia and in Europe as a whole. The main aims of SEEU are to promote inter-ethnic understanding and to ensure a multilingual and multicultural approach to teaching and research and to develop its teaching programme with a broad international and European perspective.

SEEU, as part of its mission apart from high standards implemented in the education area, is permanently working on rising ecological consciousness of its students through practical solutions. Since 2001, when SEEU campus was built, attention was paid on the environmental conservation and sustainability. Specifically, in the last few years preliminary actions for reducing direct and indirect greenhouse gases (GHG) emission in the Campus were initiated.

The final goal of the project is to completely eliminate GHG emissions, in order to achieve carbon neutrality. This will be realized through an analysis of the current energy consumptions and GHG emissions and through an integrated planning for the implementation of carbon-friendly measures. The proposed actions will be mainly oriented towards optimization measures, increasing energy efficiency and savings, mainly with the replacement of the existing technologies with new, more efficient ones. As a possible case study initiative, the design of a pilot solar power plant will be provided. The long term objective is to reduce as much as possible energy consumption by extremely high energy efficiency levels, and to use renewable sources for satisfying the residual demand. In this way, the need for fossil fuels of the campus will be eliminated, and the result of carbon neutrality will be reached.

This proposal is structured in the following sections:

- Section 2 describes the SEEU Campus and its current energy consumptions and supply;
- Section 3 illustrates the activities to be developed, in terms of objectives and technological solutions;
- Section 4 shows the proposed time schedule and expected deliverables of the project.

2 SOUTH EAST EUROPEAN UNIVERSITY

2.1 GENERAL INFORMATION

South East European University is located at 41°13'14"N, 22°13'11"E and at an elevation of 453 meters, on the southern outskirts of the city of Tetovo in Macedonia. It occupies a surface of about 200,000 m², with a net covered area of about 29,000 m² and approximately 10,000 students.

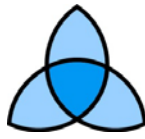
In terms of building technologies, 42% of buildings are of classical type, and 58% are built using prefabricated elements using ecologic materials. The principles of space use optimization are respected and the structures have good thermal and acoustic insulation capacity, according to international rules and standards. This allows a reduced need of energy for air conditioning, in respect to conventional structures.



Due to the university use of the structures, waste paper is the most important type of solid waste. In order to avoid wasting of natural resources and large waste production, SEEU established a system for primary separation of the paper from waste. Special paper waste bins, made of recycled paper, are located throughout all the campus. The collected waste paper is then transported to an external paper recycling plant.

As a unique example in the region, SEEU uses, for its needs, water from own resources which, after the use, is completely treated with a biological process. Waste waters are refined and leaked as “first category cleaned waters” through a high efficiency refining station built within the campus.

The refining station is very important because it significantly decreases the pollution through leaking of waste waters, minimizing the need of freshwater supply. This is particularly important, especially taking into account that there are 7,000 users and the average water consumption is of 7 l/s, equivalent to the impressive consumption of 600,000 litres per day.



2.2 CURRENT ENERGY CONSUMPTION AND SUPPLY

SEEU currently uses two main forms of energy to ensure its normal operation:

- electric power, provided by the National Grid;
- heating oil or crude oil, provided by oil refining plants.

The electric power is mainly used by consumers for:

- production of sanitary hot water;
- lighting;
- operation of computer systems;
- ventilation and air conditioning systems in the summer period ;
- primary electromotor machines.

Heating fuel or crude oil is used in the winter period for the centralized heating system, fed by oil boilers.

The average monthly consumption of energy is:

- 170 MWh (2.04 GWh annually) of electricity;
- 16,666 liters (about 200,000 liters annually) of heating oil.

Due to the characteristics of the National electricity grid, where about 70% of power production is based on coal fired power plants, the use of electricity from the Macedonian network implies the emission of a high level of carbon dioxide. Thus, the self-production of energy will significantly lower carbon emissions.



3 PROPOSED PROJECT ACTIVITIES

The basic purpose of the project is to plan and implement specific actions for the accomplishment of the zero GHG emissions target within the SEEU campus, and to improve the contribution towards the promotion of technologies in the renewable sources sector, through the dissemination and teaching of the technologies implemented within the Campus.

Carbon neutrality is defined as the process of reducing and offsetting carbon producing operations that makes the Campus net carbon emissions equal to zero. Even though this is a challenging objective, SEEU can obtain the following benefits from prioritizing the reduction of greenhouse gas emissions:

- reduce campus energy costs;
- protect against future climate regulations and energy price volatility;
- promote low-cost climate mitigation technologies; and,
- enhance the reputation of the University.

The 'road map' towards the carbon neutrality shall be based on a number of key steps, in many cases to be developed in parallel:

- engagement with campus decision makers and stakeholders;
- GHG emissions inventory;
- evaluation of projects to meet targets;
- analysis of GHG emission targets;
- evaluation of financial feasibility.

A formal, high level commitment to emission reduction shall be the starting point of the project. The SEEU Campus management shall issue an official statement for energy conservation and other emissions-reducing activities. Also, the creation of a dedicated Task Force for managing the climate action planning process will be established. Then, an initial workshop aimed at disseminating the project purposes can be held.

After this initial institutional commitment step, the first operative phase of the project (Task 1) will be the estimation of the carbon footprint of the Campus.

Task 2 will then converge on the core activity of the project, i.e. the development of a Climate Action Plan (CAP). Task 3 will be focused on the design of a demonstrative photovoltaic plant in a pilot area of the campus. Task 4 will take care of the launch and implementation of the CAP, while Task 5 will last for the whole project duration and will take care of the educational and capacity building actions.

More details on the proposed project activities are provided in the following sections

3.1 TASK 1: GHG EMISSION INVENTORY

A key step in the climate action planning process is the formulation of the university's emissions inventory to identify, quantify, and categorize major sources of GHG emissions. Performing a GHG inventory is integral to a suitable GHG reduction strategy and is a sign of long-term commitment to address climate change.

The inventory will take into account direct (on-campus heating and cooling, fleet vehicles) and indirect (purchased electricity and steam) emissions, and will be developed according to internationally recognized methodologies and tools. If records from past years are unavailable, programs will be proposed to gather the necessary information in the future.

GHG emission inventory will represent the carbon footprint of the SEEU campus, to be considered as the starting point on which the carbon reduction strategy and targets will be based.

3.2 TASK 2: PREPARATION OF A CLIMATE ACTION PLAN

The climate action planning process will explore and evaluate the most suitable options for cutting the campus emission footprint. The main purposes of the CAP are the following:

- establish a target date for climate neutrality;
- propose interim goals and actions for reducing GHG emissions;
- identify goals for reducing emissions and impacts from purchasing, campus operations, transportation, and water usage; and for improving recycling programs;
- identify mechanisms for tracking progress;
- identify financing mechanisms
- propose how campus will include climate neutrality and sustainability in curriculum, student experience, and research.

At first, all possible projects and actions aimed at reducing carbon emissions will be identified and evaluated. A cost-benefit analysis will be conducted for each project option, in order to rank them on the basis of economic, environmental and social criteria. From the economic point of view, the main economic parameters (IRR, NPV, payback time, annual cost/savings) will be analyzed. Environmental parameters will be energy saved, tons of CO₂ reduced, energy intensity, etc.. Social/Educational aspects will be also considered, in terms of support to local economy, enhancement of university recruitment levels, public relations.

The climate neutrality target shall be effectively reached through the following mechanisms:

- replacement of existing technologies mainly affording on fossil fuels, with new technologies, more efficient and/or based on the renewable sources;
- optimization of the energy consumption through the implementation of the concept of energy efficiency in the whole process of energy usage with a consequent decreasing of energy consumption.

Replacement of the existing technologies would be directed towards the following solutions that would drastically decrease the CO₂ emissions and increase the energy efficiency:

- replacement of current air conditioning system, based on a heating system using oil and on a cooling system using individual split air conditioners, with a completely integrated system using geothermal electric heat pumps both for heating and cooling. Such a system could allow an energy saving of 60% or more;
- installation of solar thermal systems, using solar energy for heating of sanitary hot water production;
- replacement of the existing bulbs with high efficiency bulbs.



Currently, the unique direct production of CO₂ at SEEU is due to the oil fired heating system.

On the other hand, the optimization of energy at SEEU will be focused mainly on a better usage of energetic resources through the consumption management, allowing elimination of energy leftovers.

Application of artificial intelligence and fuzzy logic for control and regulation of operational parameters (air quality, temperature, natural light, occupation level of rooms and services etc...) can allow the optimal tuning of energy services to their actual demand, thus allowing the elimination of energy waste and a better final service. This has a direct influence in decreasing the quantity GHG.

The optimization can be applied on the level of:

- implementation of solutions for control of maxigraphs and screens;
- implementation of solutions for control of stand by consumption of electric power after completion of the working hours in all electric appliances (printers, computers, screens etc.);
- control of lighting with upgrading of movement sensors;
- control of crude oil consumption through a heating automatic regulation system and its upgrading in the integrated system on the level of infrastructure of the whole campus;
- implementation of the so-called “intelligent buildings“ system, using wireless sensors, receptors and actuators networks able to directly manage services and environmental parameter both in indoor and open areas.

The CAP report will include the analysis of the most suitable projects and associated GHG reductions, with specific contributions to yearly and cumulative emission savings. Based on the project ranking, interim and long-term reduction targets will be defined. The possible sources of funding will be identified and evaluated, being a key factor in the projects implementation phase.

3.3 TASK 3: PILOT PROJECT FOR THE PROMOTION OF RENEWABLE ENERGY TECHNOLOGIES

Within the CAP, several climate oriented projects will be evaluated and ranked on the basis of a cost benefit analysis. New plants based on the use of renewable sources will be surely considered as high ranking options, therefore in order to move forward to the CAP implementation, this task is aimed at developing the first steps for the promotion of renewable energy technologies at SEEU and for the realization of a photovoltaic plant in a pilot area within the SEEU Campus.

Currently, there are no grid connected photovoltaic power plants in the Republic of Macedonia, but the legal framework and a good incentivating power sale tariff has been recently put in place. Thus, the legal framework allows SEEU to direct participate on the market of producers of electric power by the installation of a photovoltaic power plant.

The high price of this kind of investment has an economic justification within the governmental decision for purchase of complete production of electric power produced by photovoltaic after the preferred price in the period of 20 years.

The installation of a photovoltaic plant, using modules with 15% efficiency, on a surface of about 25,000 m² could allow a production of 2 - 2,8 GWh¹ electric power.

This case study will help demonstrating that in the future the energy needs of the SEEU Campus could be partially or completely ensured by the electric power from renewable sources.

3.4 TASK 4: LAUNCH AND IMPLEMENTATION OF THE PLAN

The CAP report developed within Task 3 will be evaluated by a duly established SEEU Committee or by the Board of Directors. This body will give the final approval of CAP recommendations and will verify the availability of the financial resources necessary for the projects implementation.

Then, a strategy for launching the short-term projects will be developed, possibly through a public consultation procedure. CAP implementation will be an iterative process and adjustments will be needed over time, since stakeholders involved in the planning process will probably raise new questions and concerns during implementation. Reduction targets and projects ranking could be tuned accordingly.

The approval and implementation phase will include public presentation of the CAP, and can be therefore seen as an opportunity to educate the campus community about climate change and plan objectives.

3.5 TASK 5: EDUCATION AND RESEARCH ACTIVITIES

The climate action planning process will represent a valuable learning opportunity for the whole SEEU campus community, especially for students. Therefore, a specific task of the project will be devoted to the development of educational and research activities.

Two phases are foreseen for the task implementation:

- Implementation of periodical dissemination workshops focusing on the CAP driving principles and measures;
- Set up of programs for formal education (post graduate study) and for the realization of a research laboratory on renewable energy technologies.

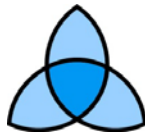
3.5.1 Dissemination Workshops

The methodological approach and the climate planning concepts will be disseminated through dedicated education and capacity building sessions throughout the project development. An initial workshop will be held for sharing the CAP driving principles and for presenting the project work plan, time schedule and expected results.

Then, specific training sessions will be organized quarterly, with the purpose of providing insights on studies and analyses undertaken within the climate planning process.

This task will be preparatory for the set up of programs for formal education and for the realization of a research laboratory on renewable energy technologies (see next section).

¹ Data from RET Screen International – Clean Energy Analysis Software.



3.5.2 Set Up of Programs for Formal Education and Research

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 the Balkan region 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 centres for the study of energy engineering problems is essential.

Within this task, a study on the methodological approach for establishing management and operative structures of the research laboratory will be developed. The study will identify and discuss the main objectives and the activities to be developed, the equipment required in the laboratory, physical planning, sequential and parallel steps for establishing the center, the cost factor and the recurring expenditure, ways of utilizing the laboratory for effective teaching and research through optimal use of the above factors.

4 TIME SCHEDULE AND DELIVERABLES

4.1 TIME SCHEDULE

The project tasks will be implemented according to the following schedule:

PROPOSED PROJECT SCHEDULE																					
TASK	Activity	MONTHS																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14						
0	Initial Commitment	0.1	Task Force creation and initial Workshop	█																	
1	GHG Inventory	1.1	Data Collection		█	█	█														
		1.2	Data Analysis and Emissions Calculation			█	█	█													
		1.3	Emission Inventory Report				█	█	█												
2	Climate Action Plan (CAP)	2.1	Reduction Target Definition				█	█													
		2.2	Projects Identification and Evaluation					█	█	█											
		2.3	Projects Ranking						█	█	█										
		2.4	Climate Action Plan report							█	█	█									
		2.5	Funding Sources Identification								█	█	█	█	█	█	█	█	█	█	
3	Pilot Project for the Promotion of Renewable Energy Technologies	3.1	Feasibility Study				█	█	█												
		3.2	Main Design						█	█	█										
		3.3	Funding Sources Identification								█	█	█	█	█	█	█	█	█	█	
4	CAP Launch and Implementation	4.1	Approval of CAP Recommendations																		
		4.2	Public Launch of Approved Projects																		
5	Education and Capacity Building	5.1	Dissemination Workshops	█					█					█					█		
		5.2	Set up of Programs for Formal Education																		

After the initial commitment, the GHG inventory (Task 1) will be completed within 3 months. CAP preparation will start 3 months after project kick-off and will have duration of 5 months. The pilot project (Task 3) design will start early in parallel with Task 1 and 2. The capacity building/education activities will be developed from project start up to the end of the project.

4.2 DELIVERABLES

The following deliverables are foreseen:

- GHG emission inventory report at the end of Task 1 (4 months after project kick-off);
- CAP report at the end of Task 2 (8 months after project kick-off);
- feasibility study and main design of the pilot photovoltaic plant at the end of Task 3 (respectively 5 and 8 months after project kick-off);
- program for formal education and study on the research laboratory establishment at the end of Task 5;
- advertising material (brochure, press release, etc.) and capacity building documents (lessons, handouts) within Task 4 and 5 where needed.

The proposed time schedule foresees the CAP public launch and implementation within approximately 1 year. The actual realization of the top ranking projects necessary to meet the planned carbon reduction target will strongly depend on: accessibility to technologies and information, cooperation with the relevant state institutions, existence of technological know how in Macedonia.