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Best Practices in Energy and Climate Change in the University of Alcalá

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Abstract. Since 2013, University of Alcalá has been taking part in the ranking of UI GreenMetric, as part of its sustainability policy. This ranking shows the effort of this University in promoting the sustainability in its three campuses and the surroundings, including the involving of all stakeholders from Rector to students. University of Alcalá has been always into the first places of Spain ranking due to the strong compromise that has been reflected in the policy of Rector's managing and the strategic plan that covers actions to the 2037 represented as objectives, actions, and indicators of these actions.

Keyword: Sustainable Facilities and Infrastructures, Sustainable Managing Waste, Strategic Plan

1. Introduction

The University of Alcalá (UAH) [1] is a public institution located in Alcalá de Henares (Madrid). Founded in 1499 by Cardinal Cisneros and declared a World Heritage Site in 1998 by UNESCO [2], it is one of the oldest universities in Europe and one of the first examples of a university city planned at the service of an educational community.

With this background, the social commitment of the UAH aims to reflect both the main missions of a public university and one of the objectives established as priorities. Years ago, the 2030 Agenda [3] proposed 17 sustainable development goals that range from the end of poverty (SDG1) to establishing alliances to achieve these objectives (SDG17), through

affordable and clean energy (SDG7) and establishing more sustainable communities and cities (SDG 11). Practically all the objectives of the 2030 Agenda are covered by the different levels of the function developed by the UAH as a public university.

Sustainable development is about "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" and is reflected in the 1987 UN Brutland report [4]. In a University, Sustainable Development must be the sustainable convergence between the economic aspect, the university community, and its correct environmental management.

The University of Alcalá is aware that its responsibility to train, expand knowledge, etc., is a benchmark to achieve a sustainable model, not only in its field, but in other social, technical, economic, etc. areas. Among one of its many functions, it must promote human behavior to achieve respect for the environment and reduce the environmental impact they generate.

In 2002 he set up the Environmental Quality and Sustainable Development working group within the Conference of Rectors of the Spanish Universities (CRUE) and in which several Spanish universities participate. The experiences of Spanish universities on their environmental management, advances in the introduction of the environment in the university community are compiled.

In 2003, the University of Alcalá made its "Environmental Policy Statement" with the aim of integrating the environmental dimension into university planning, execution, and evaluation. This Environmental Policy establishes:

- Prevent, reduce, and eliminate the negative environmental impact that may arise from university activity.
- Rationalize consumption and promote an increasing level of efficiency in the use of material and energy resources.
- Promote the prevention and valuation (recycling, recovery, and reuse) of waste.
- Inform, train, and sensitize the university community, promoting their active participation in environmental management, and in improving the quality of the university environment.
- Carry out a continuous monitoring of the environmental impact of the university activity and evaluate the degree of compliance with the objectives and goals established, in accordance with the environmental regulations applicable to the University.
- Maintain a relationship of dialogue and collaboration with public and private bodies with competence in environmental matters, which may affect the university and its area of influence.
- Adapt its environmental policy to the new demands promoted by university associations at national and international level, always with a permanent focus on continuous improvement.
- Promote in its territory of influence a policy of Environmental Excellence in Development, acting as a catalyst and advisor to it, in collaboration with public and private institutions.

This environmental policy statement has been updated within the Strategic Plan published by the UAH in 2022 [5], which aims to be a benchmark for the strategic objectives that must be met by all levels of the university until 2037, so that all the actions carried out

in it have a common line that seeks to fit with these strategic objectives. through the student secretariats to teaching, passing through the different services, such as the Office of Infrastructure Management and Maintenance (responsible for carrying out works and maintaining them) and the General Services office (responsible for courier services, supplies and consumption).

The IU GreenMetric World University Rankings [6], created by the University of Indonesia in 2010, analyzes the environmental policies, programs, and services of universities around the world, in which a total of 1,050 universities from 85 different countries currently participate. For its evaluation, it uses more than fifty indicators through which they analyze academic institutions, divided into 6 categories. IU GreenMetric experts validate the answers offered by universities based on the evidence they provide.

The results obtained by the University in the last edition, published in December 2022, show a situation of general progress. It remains one more year in the first national position in the environment and infrastructure and in energy and climate change categories, achieving the first position of the latter worldwide. And it improves its positions in the water, transport, and waste categories, being 4th, 5th and 11th respectively. In education and research, it is among the 10 bests in Spain.

This success achieved by the university in the ranking is due to its commitment to sustainable development and its active collaboration in the search for solutions to environmental conflicts, promoting efficient energy management programs and actions of awareness and involvement of the entire university community, such as sustainable mobility programs between campuses, awareness campaigns on energy saving, etc. To this is added the creation of the Environmental Quality Program, a comprehensive sustainability plan and an Office of Environmental Participation, Analysis, and Initiatives (Ecocampus) or the carbon footprint observatory. The green spaces of the universities are also very important in IU GreenMetric, in our has been valued the Royal Botanical Garden Juan Carlos I that is in the Scientific-Technological Campus: 260,000 square meters of green lung with almost 8000 different species of plants.

These excellent results join those already achieved in sustainability issues in recent years in rankings such as QS Sustainability 2023 or the UNE-EN ISO 14001: 2015 certifications of environmental management systems for all its buildings and centers and the UNE-EN ISO 50001: 2018 of energy management systems recognized uninterruptedly since 2017, which demonstrates the progress and effectiveness of advances and new implementations for the achievement of the UN Sustainable Development Goals (SDGs).

2. Ambiental Quality Program

The Environmental Quality Program of the University aims to identify and control the factors that affect the environment with the idea of making a continuous improvement of university environmental management, aims to carry out actions on energy saving and efficiency, water saving, waste management, sustainable mobility, improvement of the environment, etc.

The University of Alcalá launches the Environmental Excellence Program with the aim of promoting that the economic and human development of the Henares territory is compatible with optimal environmental quality. This social commitment is reflected in the different actions aimed at making clear the environmental commitment of the Institution, being aware of the environmental impact generated by its activity and especially its energy

consumption, which is why for years we have been working to improve this aspect and reduce consumption

energetic.

The energy and thermal consumption are distributed equally, the electricity consumption is mainly destined to the lighting both inside the buildings and outside (external Scientific-Technological Campus), staff and research equipment, part of air conditioning, especially refrigeration (not available in classrooms), DHW and other energy-consuming equipment such as kitchen and cafeteria appliances. Most of the thermal resources (natural gas) are used for heating systems. Since 2005 the University managed to stabilize consumption and from 2006 onwards it has been experiencing a reduction, especially due to energy saving and efficiency actions.

Likewise, to note that these actions have been marked mainly by the general economic situation and the financing of the Public Universities of the CAM in particular, which has led us to concentrate the maximum efforts on actions to reduce and contain current expenditure, promoting optimization and profitability actions in energy facilities and current supplies, And finally, a further step has been taken, in the field of renewable energy and energy efficiency, looking for formulas that can minimize expenses in fuels for air conditioning, and initiate paths that allow generating income from the production and sale of electrical energy..

Thanks to all the work done and the actions carried out, the University of Alcalá has become a relevant member of the "International Network of Sustainable Development Universities".

The Sectoral Commission of the Conference of Rectors of the Spanish universities of Environmental Quality, Sustainable Development and Risk Prevention highlights the actions carried out by the UAH, the waste management system, the involvement in sustainability, the good results and training and awareness measures carried out and very notably the promotion in energy measures: cogeneration, geothermal, energy saving and efficiency measures at the University of Alcalá. The National Energy Commission certified that the total electricity consumed during 2010 came from renewable energy sources. This data is just one more link in a chain of measures carried out by the University of Alcalá aimed at achieving the highest level of energy efficiency possible. Since then, the University of Alcalá has achieved and maintained different seals such as the UNE-EN ISO 14001: 2015 certifications of environmental management systems for all its buildings and centers and the UNE-EN ISO 50001: 2018 of energy management systems (scope: 'Provision of the service of management, maintenance and improvement of the efficiency of the lighting of the Historic Campus of Alcalá de Henares, Scientific and Technological Campus of Alcalá and Guadalajara Campus').

Finally, it should be noted that in this year 2023 the University has achieved the 'I reduce' certification for reducing emissions in accordance with the criteria established in the seal (Calculation/Reduction/Compensation). This register, of a voluntary nature, includes the effort of the organizations to calculate, reduce and compensate the greenhouse gas emissions generated by their activity.

The of Alcalá has achieved a new goal in terms of energy savings and its reduction of the carbon footprint. The Ministry for the Ecological Transition and the Demographic Challenge certifies the efforts of Spanish organizations in

the calculation and reduction of greenhouse gas emissions generated by their activity. At the same time, it facilitates the possibility of offsetting all or part of their carbon footprint, through a series of forestry projects located in national territory. These projects integrate numerous environmental and social benefits, among which is the absorption of carbon dioxide from the atmosphere, also known as carbon cancellation.

3. Strategic Objectives, Actions, and Indicators

All these achievements indicated in the previous section are the result of the involvement of the entire university community through the environmental management policy and the strategic plan. This plan is carried out through the establishment of sheets of goals-objectives-indicators that are developed within each of the services and units of the UAH, also involving teachers and students through the introduction of the SDGs in the teaching guides, framework document that governs the evaluation of competences, of each subject.

Some actions carried out at the UAH to achieve the strategic objectives are described below:

3.1. Photovoltaic chargers

In the Real Jardín Botánico Juan Carlos I, located in the external Scientific-Technological Campus of the University, the first electric vehicle charging point that uses sunlight to produce electricity in Spain was installed.

Figure 1. Real Jardín Botánico photovoltaic chargers

3.2. Cogeneration plant

Commissioning and operation process of a high efficiency Tri-generation Plant, with a power of 462 kW in the Polytechnic Building of the University, through which it is intended, on the one hand, to reduce the cost of heating, cooling and hot water, as well as generate income for the Institution, all minimizing greenhouse gases.

Figure 2. Co-generation plant

3.3. Smart illumination

Likewise, the University of Alcalá, presented a grant application within the Program for the Promotion of Energy Saving and Efficiency for the year 2010 of the Community of Madrid (CAM). The aforementioned project consists of an Energy Efficiency Project for the replacement of the exterior lighting of the External Scientific-Technological Campus (installation of public lighting) by another based on "Led" technology with its control and regulation components, Project for which a 30% subsidy has recently been received from the General Directorate of Industry, Energy and Mines of the Community of Madrid.

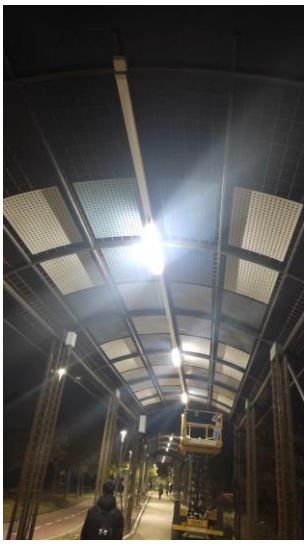

Figure 3. Smart ilumination

3.4. Geotermal plant

The University of Alcalá, within the framework of the Energy Plan of the Community of Madrid 2004 – 2012, proposed a project for the execution of an Energy Exchange System by means of a Geothermal Heat Pump that would serve the Air Conditioning System of the new Multipurpose and Modular Building, located in the External Scientific-Technological Campus. This geothermal exchange installation carried out for the air conditioning of the Building and DHW was carried out with funds from the subsidy granted by the Ministry of Economy and Finance of the Community of Madrid, within the aid program granted by the Madrid Institute of Development, for the promotion of energy saving and efficiency actions.

Figure 4. Geothermal plant

It serves a public building where higher education activities will be developed, with a total air-conditioned area of 4,690 m2 distributed over four floors. In summary, it is an exploitation of a geothermal resource of very low enthalpy (renewable resource), we consider that we are facing an installation that will produce energy savings of more than 30% over a conventional installation, with an approximate reduction of 25% in CO2 emissions. For the total integration of the installation in its environment, and to ensure the correct operation and long-term maintenance, the surface finish of the area of action was carried out, thus avoiding possible interferences from different actions.

The installation is fully integrated into its surroundings, the areas used for the installation of the 60 necessary geothermal exchangers (fields of geothermal probes) has been used as a parking and landscaping area. The construction of the car parks does not interfere with the probes since the heads are located about 70 cm. below the level of the finished surface. The hedges and trees implanted in the design of the car parks are arranged in such a way that they do not interfere with the field of probes, for this species have been chosen considering the characteristics of their roots, so that their development does not pose a danger to geothermal installations.

3.5. Improving energy efficiency in buildings

In July 2021, the University, from the Office of Infrastructures and Maintenance, requests from the Energy Rehabilitation Program of Buildings of the IDAE, aid for the Energy Rehabilitation of the envelopes of the building of the Faculty of Pharmacy of the Scientific-Technological Campus and the University Residences (CRUSA), for which these grants were granted. Thus, the necessary actions have been planned to carry out these eligible energy rehabilitation works, and other conservation and maintenance works of the building.

Based on the problems encountered, the University as a property, has marked the following general objectives of action to improve of the energy efficiency of the enclosures. This improvement is achieved by installing the following systems:

- Ventilated façade system with mineral wool insulation of 10 cm thickness and system finish of profiled panels of galvanized steel with ceramic platelets.
- Replacement of windows and doors with Thermal Break carpentry (RPT) and low emissive glass.
- Implementation of 10cmd e XPS in the current covers.

Figure 5. Improvement of energy efficiency in Pharmacy Building

3.6. Electric vehicles and chargers

The University of Alcalá has renewed the entire fleet of service vehicles to incorporate 8 100% electric vehicles and a plug-in hybrid vehicle. In addition, 10 double chargers have been installed in all the faculties of the university to initiate compliance with the Royal

Decree of December 2021 on the installation of electric vehicle chargers. Among these vehicles are the official cars, vans of the Maintenance Service and Technological Office, which complement the first 100% electric vehicle available to General Services.

4. Conclusions and Future Works

In short, the University of Alcalá is committed to the environment and sustainable development policies. For almost twenty years it has been developing sustainable development policies and the last year it has been reflected in its strategic plan. In addition, the UAH continues to develop these objectives through its plans to install 4MWp of solar panels, to reduce dependence on fossil fuels.

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