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ECOLOGICAL FOOTPRINT REDUCTION RECOMMENDATIONS FOR HIGHER EDUCATION INSTITUTIONS

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TITLE

Ecological footprint reduction recommendations for Higher Education Institutions

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EUSTEPs
Enhancing Universities' Sustainability TEaching and Practices through Ecological Footprint

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1. The Ecological Footprint as a sustainability assessment tool for Higher Education Institutions towards the SDGs

Higher Education Institutions (HEI)1 foster a community of millions around the world. Their everyday functioning encompasses a range of activities, from teaching and researching to operational, administrative, and management procedures. HEI act as the main drivers of knowledge creation and dissemination in society, as they perform the role of incubators and preparatory academies of tomorrow's leaders and civil society members (Moreno Pires et al., 2020).

Sustainable development stands as one of the main challenges of today's world, as we are walking on a dangerous path for humankind and life on planet Earth. The last decades of the 20th century, up until today, have been critical in raising awareness of politicians, major world players, and civil society about the catastrophic scenario that is ahead of us. There have been several attempts to address and embed it into the world's main political and social agendas. From the very first definition of sustainable development in 1987, up until the UN Agenda 2030 and the Sustainable Development Goals (SDGs) approved in 2015, humanity has been progressing and equipping itself with tools to adapt to, and mitigate the consequences of, a possible catastrophe.

HEI can then act as transformative agents and shape the sustainability knowledge and skills of communities. Alongside teaching and researching such topics, it becomes crucial for HEI to commit to practicing sustainability and thus equip themselves with tools to measure the impacts they pose on the environment (Alshuwaikhat et al., 2016), while also providing recommendations to their decision-makers (Amaral et al., 2015). One of such tools is the Ecological Footprint. A well-known accounting system for resource sustainability, the Ecological Footprint has an acknowledged capacity to communicate the scale and significance of humanity's overuse of the planet's natural resources in simple and powerful terms (Collins et al., 2020). It measures the impact that human activities have on the planet's ecosystems, thus aiding in grasping the limits of these (Bastianoni et al., 2012). Also, it is a useful tool to understand and discuss how all the dimensions of everyday life may affect sustainable development.

The Ecological Footprint methodology stands as one of the sustainability assessment tools available for HEI, providing critical information for these institutions and assisting them in pursuing a more sustainable path (Genta et al., 2022). This accounting tool not only helps to raise awareness around complex sustainability challenges, but also provides insights on the most resounding operations that take place within campuses' boundaries, and the overall impact of HEI on the environment (Lambrechts & Van Liedekerke, 2014). As an environmental sustainability assessment tool for HEI, the Ecological Footprint provides helpful insights on the Institution's evolution towards the Sustainable Development Goals,

1 The term University and Higher Education Institution (HEI) are used interchangeably in the text.

guiding all HEI's community on attaining them. Figure 1 represents the connection between the Ecological Footprint and the 17 SDGs in the context of HEI.

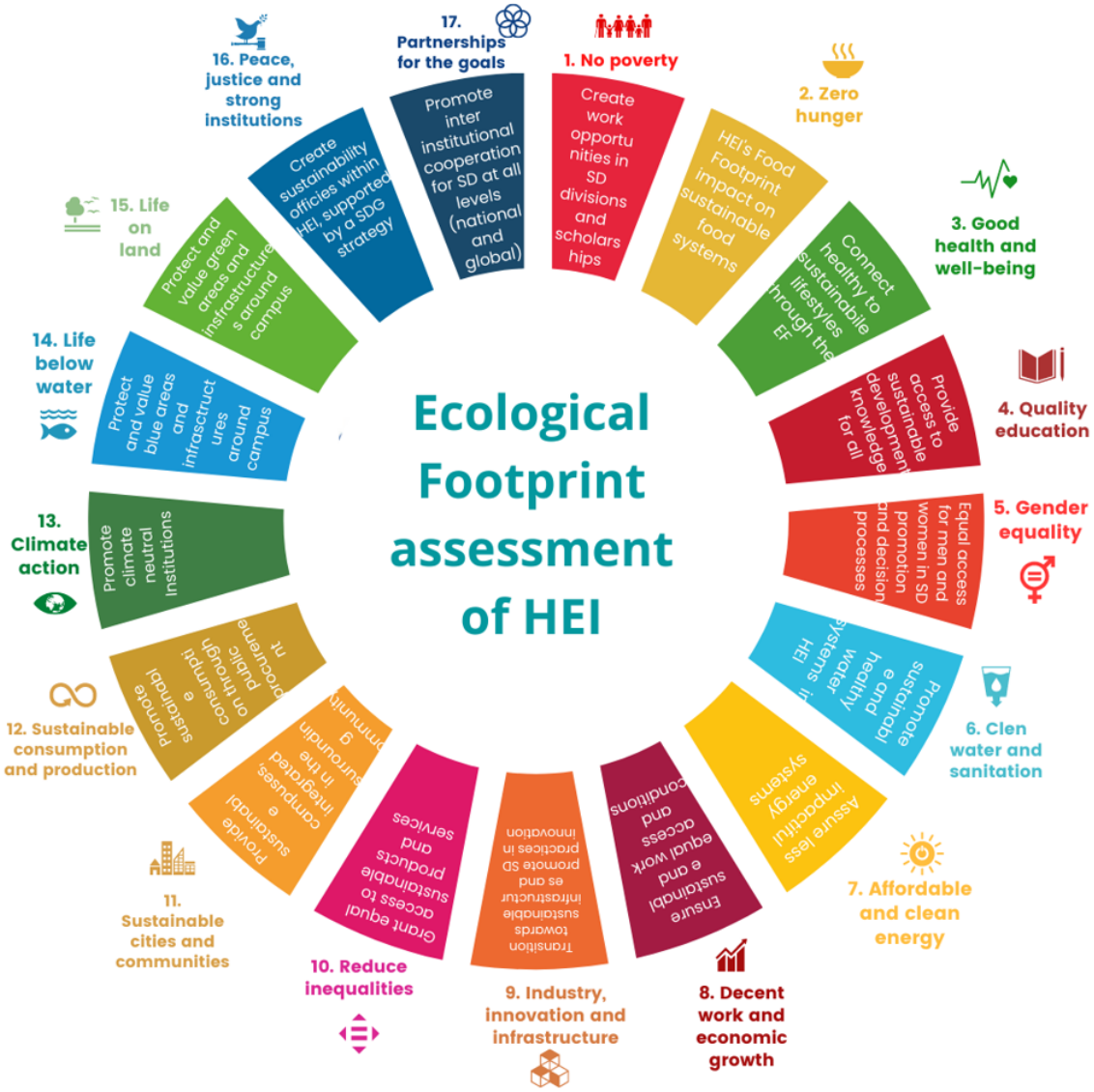

Figure 1. The link between the Ecological Footprint and the SDGs at HEI
Source: Author's elaboration

The Ecological Footprint can be associated with all SDGs (as shown in Figure 1), but most importantly it enables a clearer understanding of the main environmental impact areas and action for HEI, related to SDG 12 (Sustainable and Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life below water), and SDG 15 (Life on land). Assessing the Ecological Footprint of any HEI also contributes to SDG 4 (Quality Education, mainly target 4.7.), as it empowers all academic and non-academic community members to access knowledge related to sustainable development, to be aware of the issue and to make more conscious decisions, individually and collectively. Furthermore, it provides critical information to understand the impact of food products, processes, and actors in

HEI' sustainability while addressing SDG 2 (Zero Hunger) and supporting SDG 7 (Affordable and Clean Energy) and SDG 9 (Industry, Innovation, and Infrastructure) in green and blue infrastructures and other related actions. Finally, SDG 16 (Peace, Justice, and Strong Institutions) and SDG 17 (Partnership for the Goals) arise as extremely relevant Goals for the Ecological Footprint as, applied to HEI, the EF can enable institutional transformation for more responsible, fair, and sustainable Institutions (SDG 16). It can also promote HEI global responsibility and international cooperation for understanding their planetary impacts and ways to coordinate international efforts to reduce them (SDG 17).

2. The EUSTEPs University Footprint Calculator

The University Footprint Calculator (*https://eusteps.footprintcalculator.org/*), developed within the EUSTEPs project (https://www.eusteps.eu/), is an open digital tool that allows each HEI to keep track of the consumption of natural resources and ecosystem services demanded running its activities and operations for the ultimate scope of providing education, conducting research and outreaching to society. It is based on a standardized Ecological Footprint methodological approach, specifically tailored to be applicable to Higher Education Institutions. The Calculator aims at helping HEI to become real **transformative agents for sustainability** by identifying the major drivers of the impact of their activities and operations, thus determining the main areas of intervention to optimize their efficiency in the use of natural resources and ecosystem services.

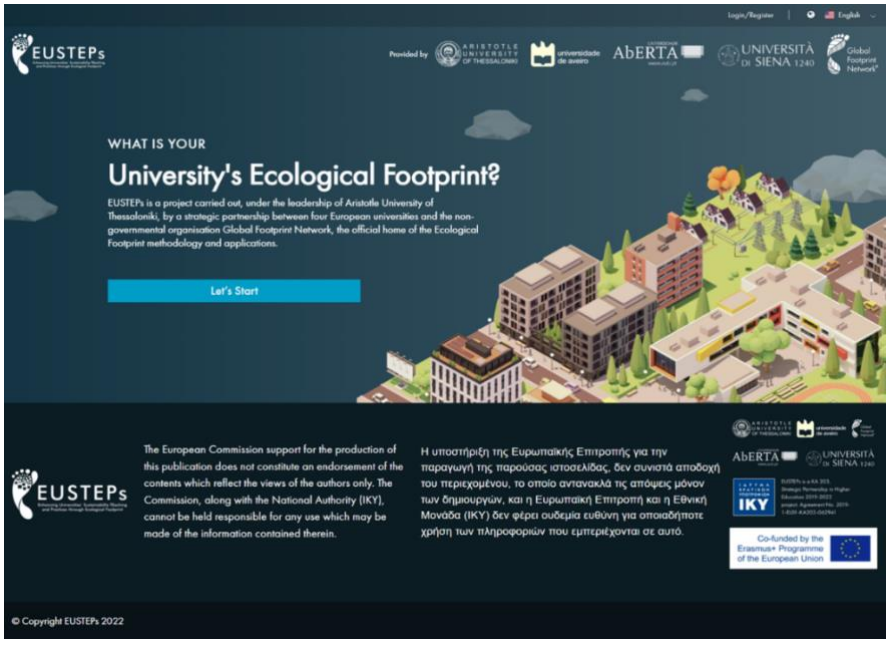

Figure 2. The EUSTEPs University Footprint Calculator landing page. Available at: eusteps.footprintcalculator.org

The Calculator was created within the scope of the EUSTEPs project (Enhancing Universities' Sustainability TEaching and Practices)2 through a participative approach and by leveraging the shared experiences and skills of the 5 project partners. The process of development took nearly 18 months and involved educators, researchers, administrative staff, PhD and MSc students, as well as ICT experts. In addition, consultations were conducted with external sustainability experts from other Universities.

Since its first release in April 2022, the Calculator is freely available and accessible for any HEI around the world (*https://eusteps.footprintcalculator.org/)*. However, since the EUSTEPs project is a European-funded project, it uses in its calculations a library of country-specific conversion factors and Footprint intensities that are relative to the EU-27 region (plus the United Kingdom). This fact does not prevent any HEI who wish to apply the Calculator outside the EU to do so, although they will have to do so by selecting an EU country as the location and accepting a certain degree of approximations in the final results.

Ultimately, the Calculator can also be used to streamline the collection and management of data required to assess the scale and significance of Footprint results. It is expected to eventually help trigger fruitful discussions on the improvements and actions needed for improving the sustainability of University Institutions by involving the whole academic community. As such, the University Footprint Calculator represents an interactive and educational tool for raising awareness and facilitating the understanding of the environmental impacts of HEI among management and administrative staff, but also students, researchers, and educators, by involving them in the process of calculation and in the discussion of solutions to reduce the impacts.

2 The EUSTEPs project (https://www.eusteps.eu/) is an European ERASMUS+ funded project that arises from a strategic partnership among Aristotle University of Thessaloniki (AUTh), Greece, University of Aveiro (UAV) and Universidade Aberta (UAb), Portugal, University of Siena (UNISI), Italy, and the international Non-Governmental Organization Global Footprint Network (GFN), based in California (USA), with the aim of introducing and educating the European academic community on sustainability, resorting to a broader and holistic approach, tackling the most urgent issues and topics that currently impair a sustainable development.

3. Recommendations to reduce the Universities' Ecological Footprint

The pilot application of the University Footprint Calculator to the four (4) Universities involved in the EUSTEPs project has helped the team to assess both the feasibility of data collection and Ecological Footprint calculation, as well as the usefulness of the results obtained, and their relevance for the University administration and management bodies. These two aspects are discussed in the following sections, which provide recommendations on data collection, handling, and management and on Ecological Footprint reduction actions.

3.1. Data Management Recommendations

Gathering data from multiple sources and databases within each HEI is a challenging task, also because it implies coordinating the data collection process with different offices, departments and persons. Based on the outcomes of the pilot phase undertaken, the main recommendations for HEI that aim to assess their EF and use the Calculator are proposed by three main categories: **WHO** should be responsible for the collection of Calculator-relevant data, **WHAT** is the required data to be collected, and **HOW** to systematically analyze EF results in the long-term for strategic sustainability institutional transition purposes (see Figure 3).

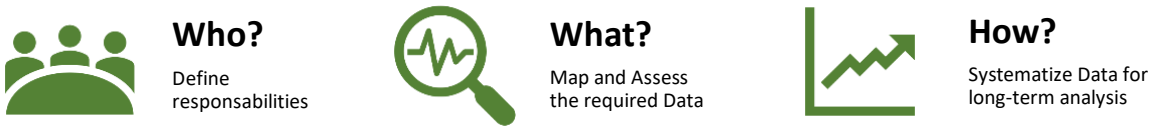

Figure 3. Dimensions of Data Management Recommendations

a) WHO should be responsible?

The main intended users of the EUSTEPs Footprint Calculator are representatives of the management and/or administrative bodies of each HEI, which are supposed to have access to all the technical and specific information regarding the whole Institution, as well as its different departments, units and offices.

Ideally, the specific office responsible for using the Calculator should deal with the overall sustainability practices of the Institution, so that they might help the Institution to realize the issue at stake and act as a driver to enforce the interventions for reducing the Footprint. When data collection and analysis are coordinated by a dedicated team, with the support of the Rector or key managerial bodies of the HEI, the whole process ends up being more efficient and results more robust and reliable.

Nevertheless, the Calculator is open to all interested users. For instance, a professor from a certain University might want to use it to try assessing the Footprint of its Institution, although he/she should bear in mind that coordination with several offices might be necessary to collect the input data needed for the calculation. For this reason, the ideal target user of this University Footprint Calculator is the head (or any other staff person) of the University sustainability office, or any other representative from the administration/management who has direct access to data.

Ensuring the team/office in charge of collecting Ecological Footprint related data is the same, or works closely with, the office responsible for other assessments, rankings or reporting tools (e.g. Sustainability Tracking Assessment & Rating System-STARS, Time Higher Education Impact Ranking-THE, among others) that HEI applies, is of added value. Streamlining data collection and ensuring that data – once collected – is consistently used for multiple monitoring and reporting purposes is key, especially considering that most of the data is used in multiple assessment tools.

At the same time, it is important to increase the awareness of the whole administrative and management staff who will participate in the data collection process about the main purpose of the Calculator, so that they feel engaged in the process and realize the importance of the task. Experience from the four (4) pilot Universities in the EUSTEPs project shows that the administrative staff participating in the EUSTEPs training events were more active and enthusiastic to help with the work around the Calculator. In this case, before starting the data collection, sending a general email by the Rector or the authorized member of the Sustainability Office to relevant administrative and management staff could be helpful to show the importance of their collaboration.

b) WHAT is the required data?

One of the key features of the EUSTEPs Calculator is that it can be used even if the HEI does not have all the required data for every parameter under analysis. As HEI can have different capacities to provide and collect specific data, they are recommended to use the Calculator – and thus assess their Ecological Footprint – even partially. This strengthens the universal character that the Calculator intends to bring, which is to be able to be used by any HEI in the world, even with a partial dataset available to be entered into the tool.

A key recommendation before using the Calculator is to first identify all data sources and map data procedures to then be able to collect disaggregated data from the various offices. It may be useful to consult and download the provided Calculator template listing all the input data required (excel file version of the input data). During the overall process, the four Universities came across some difficulties regarding the data collection process, and finding a suitable solution for issues can be accomplished by a set of key recommendations. Table 1 shows some of the recommendations to smooth the data collection process for the Calculator implementation.

Table 1. Key recommendations to improve data collection for running the EF calculator

Calculator categories	Key recommendations
General information and University Population	▪ The definitions of what to include for staff and students are provided by the calculator in the information boxes, and they are quite detailed. However, that does not prevent the HEI to stick to any previous definition already being used for other assessments. So, we recommend HEI to use the same definition used for other assessment tools or rankings. ▪ To include incoming and outgoing Erasmus students can be challenging, so HEI can opt not to include them. ▪ As for the number of publications, a good practice is to collect data on this number taking as reference the document search at the Scopus dataset. This method should be used yearly, so that it can become a standardized and comparable procedure.
University buildings and Recreational Areas	▪ It can be difficult to classify the area covered by the buildings. The use of GIS systems can better help with this classification.
Energy Consumption (Direct Responsibility)	▪ To provide the annual consumption of electricity or energy for heating, cooling and hot water generation, data can be more easily collected from the bills of each utility referring to the year of reference. ▪ If disaggregated data by buildings is not available, values referred to the whole campus can be provided.
Food (Direct Responsibility)	▪ Collecting data for this category can be a very time-consuming process as it requires to categorize food items in Food Footprint macro-categories. This categorization should follow the standardized classification/coding system of the UN COICOP classification, which provides clear definitions (for further info see: https://unstats.un.org/unsd/classifications/unsdclassifications/COICOP_2018_-_pre-edited_white_cover_version_-_2018-12-26.pdf) ▪ Assessing food waste or the percentage of food that is organic or coming from local producers were some of the most challenging aspects for all partners Universities. One recommendation would be to implement a measurement system that assesses the amount of food waste generated from food served within the university. Another is to check the procurement criteria of the University to see if the Institution details the source or mode of production of the food that is purchased.
Transportation and Mobility (Direct Responsibility)	▪ For HEI it can be a challenge, as well as time-consuming, to count the total number of km per mode of transportation of staff and students if data is not well organized. HEI can then set up a system for which the reimbursement of travel expenses of students and staff requires mandatory inclusion of the mode of transportation and the length (km) of the travel made.
Water Use and Waste Management	▪ European HEI can use the waste classification of the European Waste List to support data collection. ▪ Users should consider the weight of waste at the point of origin (e.g., at the University), not at the point of destination (e.g., landfill or recycle premises). ▪ Since the Calculator does not consider, for the time being, the waste treatment options (if it is reused or recycled or if it goes to the landfill), there is no need to collect this data.
Indirect responsibility data	▪ For Tier 2, it is important to share in advance a questionnaire to students and staff on a yearly basis about commuting practices (mode and distance of transport to University), food consumed at home, and energy consumption at home. ▪ Once surveys are collected from all the interviewees, each data pertaining to the same field needs to be summed up and the average need to be calculated, keeping the differentiation between the group of staff and the group of students. Average data can then be inputted into the relative field in the Calculator.

c) HOW to systematize data for long-term analysis?

The University Footprint Calculator allows HEI to record yearly assessments and to track changes or improvements in the EF results over time. This enables to systematize, organize and then provide a process for all the data needed for the EF assessment, year by year. A key recommendation is to use this annual comparative opportunity to provide key insights for the development and communication of a Sustainability Report or a Strategy for a Sustainable Campus. The strategic use of the Calculator results can support internal and external debates on how HEI can effectively tackle environmental sustainability, thus contributing to progresses towards the SDGs.

3.2. Operational Recommendations to reduce the Ecological Footprint

Recommendations of activities, programs or operational actions that can be implemented by HEI to reduce the key drivers of their EF are summarized in Table 2. For each recommendation (TOP TIP), the **goal** and a **short description** are provided to explain the expected actions from the HEI.

The **potential capacity** of each recommendation for **reducing the Ecological Footprint** of the HEI is identified qualitatively, in which the number of allocated 👣 for each recommendation can show the capacity of reduction (the minimum capacity is 👣 and the maximum is 👣👣👣). Recommendations are ordered from the most to the least impactful ones.

The **estimation of the costs** for implementing each recommendation in the HEI is also identified qualitatively, in which the minimum cost impact is considered as € and the maximum is € € €. Given the EF reduction potential, recommendations are then ordered from the less expensive to the more expensive.

Furthermore, the **time needed to implement** the recommendation is identified qualitatively, in which the minimum time required is considered by ⏱ and the maximum by ⏱⏱⏱.

Given the EF reduction potential and the estimated cost, recommendations are ordered from the ones that can be implemented faster to the ones that need more time.

Finally, the link with the **Sustainable Development Goals** is also provided, identifying the most relevant SDG:

The column “related SDGs” in table 3 does not mean that only those SDGs are relevant to the recommendations. Several SDGs can be linked with each recommendation, however, here we mainly highlighted the SDGs that have a remarkable linkage with the selected recommendation.

Based on the results of the pilot phase, the most impactful categories for the Ecological Footprint of the partner Universities were identified in Energy, Food, and Mobility. Therefore, the proposed recommendations focus mainly on these three categories. We also suggest some recommendations on other categories with a lower impact on the EF such as water consumption and waste management, and materials and equipment.

It would be important, nevertheless, that these actions are integrated into a comprehensive Sustainability Strategy, a Roadmap for Carbon Neutrality, or a Nature Positive HEI Strategy.

Table 2. Top Tips for the Ecological Footprint reduction at Universities

Top Tip #	Recommendation Goal	Description	Main category	EF reduction potential	Estimated costs	Estimated timeframe	Related SDGs
1	Reduce food waste	Distribute excess-food from the campus through the sale after closing time, or donate them to a local food bank/charity, and redirect to food compost all the remaining food that is not distributed (assess/measure the quantity of food waste)					
2	Promote sustainable commuting	Support and incentivize sustainable travel initiatives (e.g., discounted monthly pass for public transport, increase the payment for car parking at the university, promote a monthly day without cars, online app for car-sharing, students' app to compete for the sustainable University-related "lifestyle" to encourage walking, cycling, the use of public transport and car sharing among both staff and students.					
3	Increase the share of renewable energy sources	Increase the share of the renewable energy consumption obtained from photovoltaic, wind, geothermal or other sources.					
4	Switch to electric vehicles	Gradually replace the fleet of vehicles owned by the University with electric vehicles.					

5	Implement a “One day a week, work from home”	Reduce the number of days a week that staff is commuting to the University			
6	Eliminate single-use plastic	Eliminate single-use plastic (e.g., Items packed in plastic, bottles of water), disposable cups, and single-use cutlery while increasing at the same time the number of drinking fountains.			
7	Promote the reduction of animal protein consumption in University canteens	Replace a percentage of the consumption of meat or fish with nutrient equivalent and adequate vegetarian products, ideally sourced/procured from local producers.			
8	Promote Food Footprint Literacy	Provide visual tools that show the EF impact of each type of menu in the canteens to increase the awareness of students and staff about their choices. Develop a communication and education strategy on Food Footprint to enlarge food literacy in the whole academic community.			
9	Reduce carbon emissions from staff air travel	Encourage to reduce traveling by air (for short distances) and propose a limited number of flight trips or a carbon budget per staff.			

10	Support the development of Energy Communities	Support the development of an energy community with the neighboring community, producing and consuming energy through the same renewable energy sources.			
11	Promote sustainable renovation of buildings	Apply for available funding programs to reconvert or build energy-efficient infrastructures and nature-based solutions using sustainable materials and energy-efficient systems.			
12	Optimize the waste management system at University	Optimize facilities and processes and develop a waste management and collection plan.			
13	Develop waste reduction literacy campaigns	Develop and implement awareness campaigns for waste reduction, engaging the entire University community.			
14	Promote circular economy within University	Implement a University second-hand shop or repair cafe to buy or sell/rent used products/materials/equipment, supported by an online system, to communicate availability and prices.			

15	Move to nearly all LED lighting	Replace all lights with LED lighting.			
16	Promote University vegetable garden	Support the development of University vegetable gardens, open to students, staff and the surrounding communities.			
17	Build bicycle or scooter facilities between campuses	Implement bicycle or scooter facilities (green lines) inside the HEI to commute between the campuses, or add bicycle stands and fixing stations within the University premises.			
18	Promote water reuse and effective wastewater management	Implement water conservation and reuse systems and effective wastewater management.			
19	Switch to organic and locally produced fruit and vegetables	Replace up to 50% (or more) of the purchased fruit and vegetables with organic, locally produced ones.			
20	Implement a battery storage system	Support resiliency for the local power grid, and promote a storage solution for future renewable energy projects.			

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EUSTEPs
Enhancing Universities' Sustainability TEaching and Practices through Ecological Footprint

EUSTEPs is a project carried out, under the leadership of Aristotle University of Thessaloniki, by the strategic partnership between four European universities and non- governmental organisation Global Footprint Network, the official home of the Ecological Footprint methodology and applications.

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