

UPRM Green Campus

*Campus Verde Project: EcoSolar House
by Dr. Sandra Cruz-Pol, Dr. José Colom-Ustáriz*



**University of Puerto Rico
at Mayagüez**

Solar EcoHouse, Project of
Campus Verde– UPRM

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Alignment with the University of Puerto Rico at Mayagüez Strategic Plan

UPRM Strategic Plan: Vision, Mission and Objectives	Objectives
<p>The Vision of UPRM is “To be a leading institution in higher education and research, transforming society through the pursuit of knowledge in an environment of ethics, justice, and peace.”</p>	<p>Green buildings and sustainable technologies and practices are the way to the future. Campus Verde projects within the EcoSolar House and outreach activities take into account the latest knowledge in social ethics and environmental conscience, which lead to justice and peace.</p>
<p>The Mission of UPRM is “To provide excellent service to Puerto Rico and to the world: Forming educated, cultivated, capable, critical thinking citizens professionally prepared in the fields of agricultural sciences, engineering, arts, sciences, and business administration so they may contribute to the educational, cultural, social, technological and economic development. Performing creative work, research and service to meet society’s needs and to make available the results of these activities.”</p>	<p>The projects promoted through CV bring together interdisciplinary teams of students working together in the fields of agricultural sciences, engineering, art, sciences and business as demonstrated by our numerous previous projects such as the aquaponics, photovoltaic system, solar-electric car, EcoSolar house and many others. Our society is facing the biggest challenge in human history: climate change, and CV educates and implements measures to reduce our impact in the natural resources.</p>
<p>Objective #1.4: To develop an assessment plan that examines the performance-level of internal processes as well as the effectiveness of teaching-learning processes.</p>	<p>CV administers an annual survey to learn about the academic community knowledge in sustainability topics. It shows consistent growth in all the questions and it is available online and in our annual reports.</p>
<p>Objective #2: To lead higher education throughout Puerto Rico while guaranteeing the best education for our students</p>	<p>CV provides students with enriching educational experiences through projects in energy audits, solar energy, green buildings, and many more. This complements knowledge learned in class providing hands on activities, in numerous project course for which CV director has been the sponsor. http://campusverde.uprm.edu/CampusVerde_Report2014.pdf</p>

<p>Objective #3. To provide an adequate and pleasing atmosphere to support teaching learning processes</p>	<p>The EcoSolar house provides the perfect environment to implement multi-disciplinary projects involving the fields of agricultural sciences, engineering and others while serving as a showcase for all types of audiences</p>
<p>Objective #4: To adopt efficient and expedient administrative procedures.</p>	<p>CV has sponsor numerous INGE 4008 projects since 2008 to study efficiency of lighting in campus buildings, campus recycling, efficiency of vending machines, energy audits, LEED certification for EcoSolar house and many others. The final reports offer suggestions on how to save water, energy and other resources on campus.</p>
<p>Objective #5: To strengthen research and competitive creative endeavors.</p>	<p>The EcoSolar house has the power to motivate students from multidisciplinary teams to work together in several areas of sustainability research and technology to develop creative exhibits that demonstrate how to use Earth resources in a socially/responsible-ethical-economical-ecological manner.</p>
<p>Objective #6: To influence our Puerto Rican society</p>	<p>The house will serve as a showcase of sustainable technologies and practices to educate the general public on how to save energy, water and other resources while protecting our environment.</p>
<p>Objective #7: To strengthen school spirit, pride and identity</p>	<p>The EcoSolar house is quickly becoming an icon of our university, which has already received many visits from K-12 and UPRM academic groups. Due to its close proximity to the Mayagüez Zoo, we expect this trend to continue, increasing the number of students involved in projects and the visitors including alumni, which will strengthen the Colegio spirit, pride and identity.</p>



Campus Verde Background

The Campus Verde (CV) program, located at the University of Puerto Rico Mayagüez, strives to integrate environmental knowledge into all relevant disciplines; to improve environmental-studies course offerings; provide opportunities for students to study campus and local environmental problems; conduct environmental audits of its practices; promote environmentally responsible purchasing policies; reduce campus waste; maximize energy efficiency; make environmental sustainability a top priority in land-use, transportation, and building planning; establish a student environmental center; and to support students who seek environmentally responsible careers.

Education to students and community are also integrated through several *Green Adventures* and *Green Events* such as: Leaders for Kayak, Surfing, Hiking, Rappelling and other outdoor activities. CV also formed a Tree cutting/evaluation committee with expert faculty in related areas. Other Green Events include Eco-cine, Beach cleanups, Waterfall Cleanups, Tree Planting, Conferences, Concerts, and many Global Activities such as the International Climate Action Day (350.org), Earthweek, and EarthHour. Campus Verde also supports collaboration in research student teams from Project Courses (INEL 4008) in topics such as recycling, vertical agriculture, renewable energy and LEED certification.

This multi-disciplinary initiative was founded at the University of Puerto Rico Mayagüez in 2007. One of the main goals of CV is to lead and support projects and activities related to sustainability topics. These activities are not only for the University community, since reaching every person in Puerto Rico through outreach and education initiatives beyond the campus is also one of the goals of Campus Verde. Activities are focused around educating the general community on how to live in a sustainable manner with the resources of our Planet.

CV also serves as an umbrella for several ecological student chapter organizations facilitating collaborations between all students and faculty from different backgrounds joined by a common goal and interest. Campus Verde, together with the student associations facilitates and supports several initiatives to help and educate the community. Some of these initiatives, among several, are field trips focused in enjoying our natural resources while not disturbing the natural habitat and keeping them clean and in their natural state.



<http://campusverde.uprm.edu/estudiantes.html>, <http://unicef.uprm.edu> <http://campusverde.uprm.edu/greenbuildings.html>
<http://bike.uprm.edu>

Figure 1 shows several initiatives run by students and faculty, in collaboration with the general community and in coordination with the Town's Municipality to help keep the Island's water bodies free of human contamination.

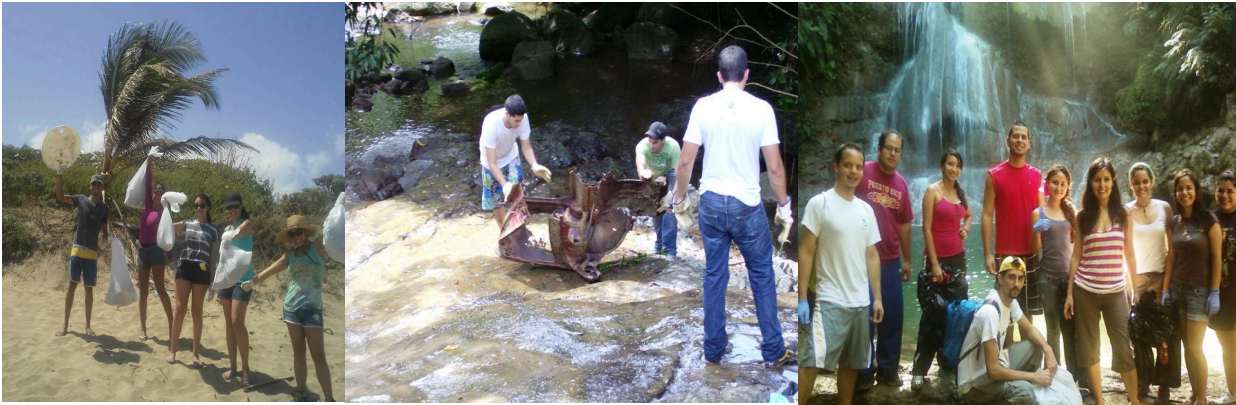


Figure 1 – Cleanup days at a) Golondrinas Beach at Isabela, b) Salto la Encantada in Añasco, c) Gozalandia in San Sebastian.

Figure 2 below shows pictures of activities coordinated by Campus Verde, in this particular case kayaking and surfing shows the community how to enjoy our water resources without disturbing the natural surroundings.



Figure 2 – a) Kayaking in Lajas b) Surfing classes at Rincón.

EcoSolar House

In order to reach more people and provide them with a real life experience in how to conserve our resources, Campus Verde have recently completed Phase-1 of a *Green Living Showcase*, which used as a benchmark the 2005 UPR Solar Decathlon House. The house was part of a competition in Washington DC sponsored by the University of Puerto Rico, in a multi-Campus and multi-disciplinary effort.

After the competition was over, the house was returned to the University of Puerto Rico at Mayagüez, and Campus Verde, started with renovations 7 years ago to modify the house to an EcoSolar House that will serve as an educational platform to educate the community in how to

live in harmony with the Planet. This project is one of the most ambitious yet by Campus Verde and it is expected that, once is completed in all its phases, to serve also as a research laboratory for faculty and students to develop research initiatives in areas focused in sustainability technologies.

The EcoSolar House will be a showcase of green living that will provide current knowledge about sustainability, the environment, green technologies and conservation practices for the academic and general community. The Green Buildings and Sustainability (GBS) UPRM chapter, in collaboration with faculty/students from several disciplines, will have the opportunity to work hands-on with the continuous development of the house, which will involve education, research and sustainability technologies. They will acquire the practical knowledge of each system's function to be implemented within the EcoSolar House. These systems involve solar panels technology; water recycling system, eco-friendly construction materials, and sustainable practical training.



The closeness to the Mayagüez Zoo, makes it also ideal to combine the regular school tours to the Zoo with a visit to the EcoSolar House which will have the potential of impacting thousands of visitors a year. Figure 3 and 4 shows the easy accessibility to the EcoSolar house from Route 2, and the close proximity to the Mayaguez Zoo.

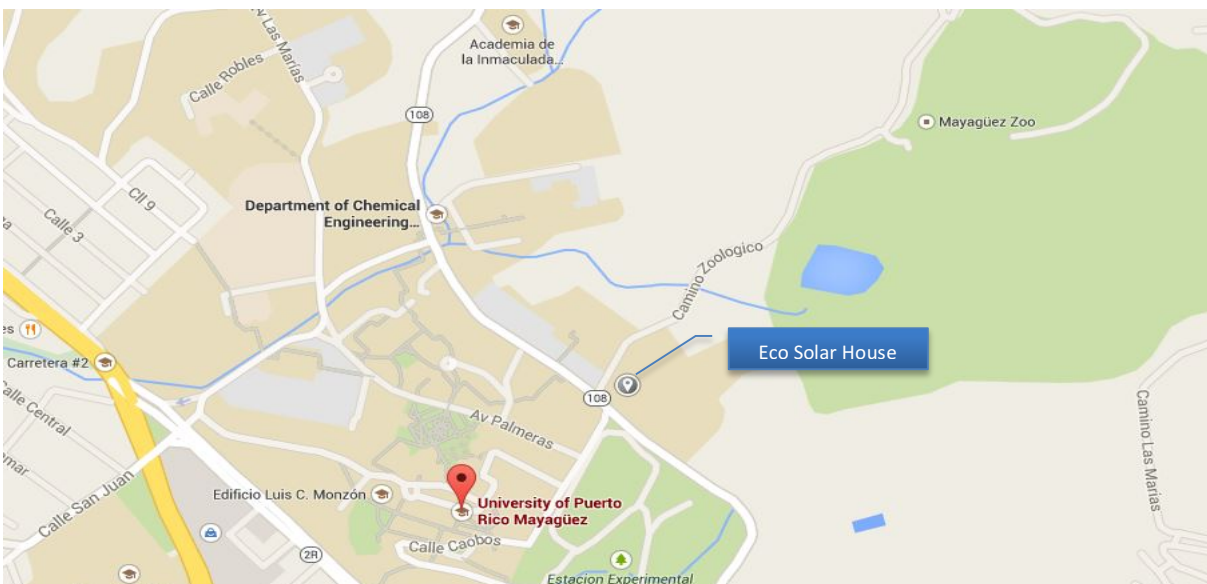


Figure 3 - EcoSolar House location is easily accessible from route 2. Between UPRM main campus and Mayagüez Zoo. [Image from Google].

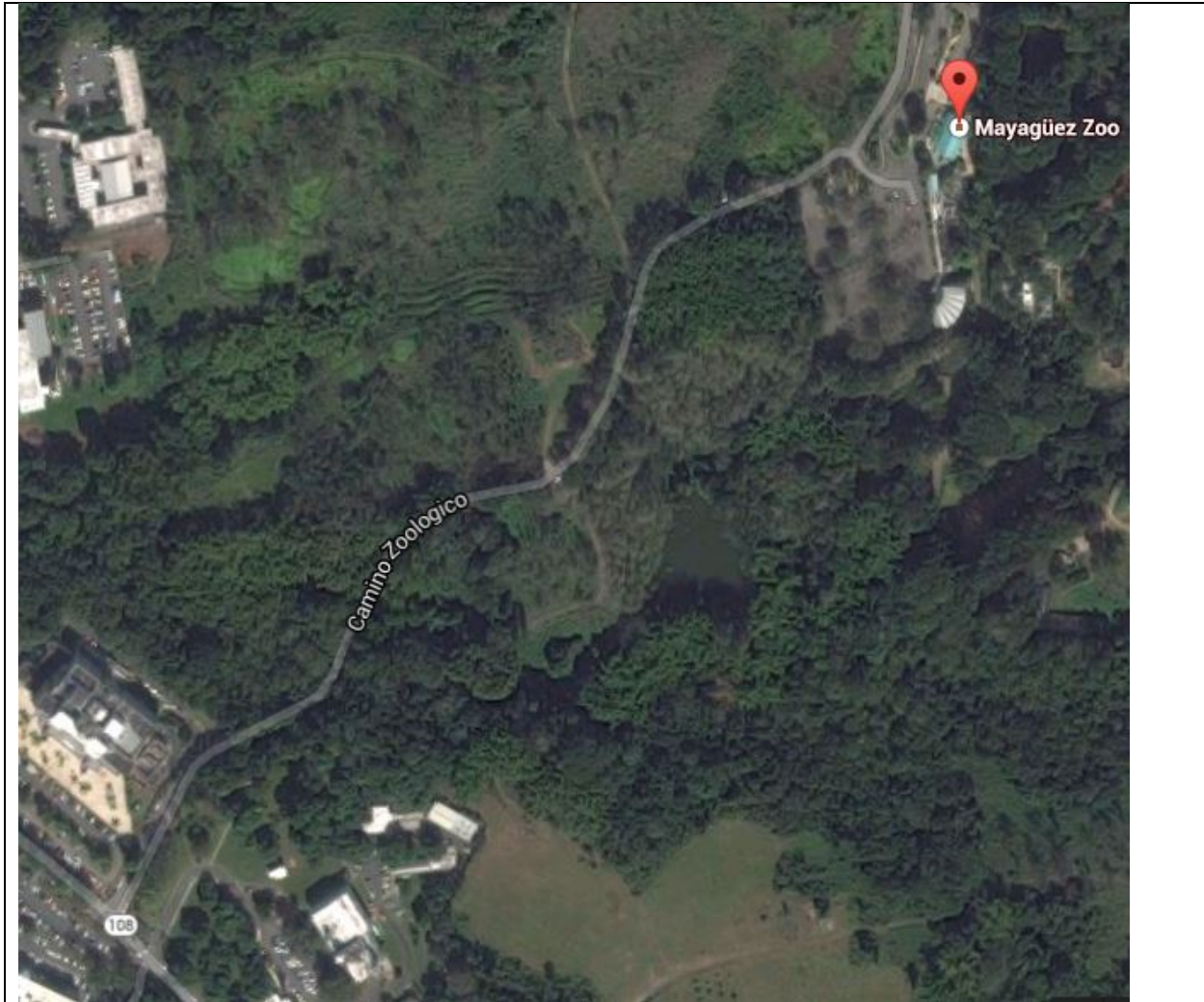


Figure 4 – Proximity from EcoSolar House to Mayagüez Zoo. About 2 minutes drive through Camino Zoológico. [Image from Google].

Current Status of EcoSolar House

During the Spring semester of 2015, Phase-1 of the EcoSolar House was successfully completed. The reconstruction of the house serves as a living laboratory to students from several associations such as Green Buildings, Campus Verde, Ride-a-Bike, and others. Students from several departments, worked together with faculty and staff to finish the house in time for an opening ceremony with the World's known British scientist and environmentalist Dr. Jane Goodall.

Phase 1 consisted in the assembly of the main structure including: fully operational with solar energy (Donation by Máximo Solar Products), LED lightning fixtures installation (UPRM ECE-LEDs, fabricated in Campus), painting of the house with eco-friendly products (Donation by Masters Paint), wooden decks, access ramp, window concrete boxes for vegetable growing, eco-friendly flooring, and a few basic appliances. See Figure 5 for details.



Figure 5 – a) Student addressing guests during opening of EcoSolar House with other students, faculty members, Dr. Jane Goodall and Chancellor listening b) EcoSolar house during final details, eco friendly painting, solar panels and access ramp with wooden decks are all visible

Proposal

While there have been a significant progress in the last few months to complete the EcoSolar house, Campus Verde's vision to reach the ultimate goal of converting the house in an educational platform for the community will become a reality during the completion of Phase-2 of the modification, which is proposed in this document.

In this proposal, support is requested to complete the Phase-2 of the house. Among those areas that will be addressed in phase-2 is the conservation and proper re-use of water through a living showcase that will help educate the community by experiencing the implementation of current water resource conservation techniques installed throughout the house. It is expected that this facility will receive hundreds of visitors annually and will include visitors from off-island as well. It will serve to implement sustainability demos and projects from several interrelated disciplines.

A few years ago, our vision concerning the EcoSolar House was to create an infrastructure where people can learn how to live in harmony with nature and acquire sustainable practices to reduce our ecological footprint. While we are moving forward in that direction, there are still areas that need to be addressed to make the EcoSolar house available to the community. We are focusing in seven different areas entitled Seven Green Resolutions, which include:

1. The 3 R's (Recycling, Reducing, Reusing)
2. Energy Efficiency and Conservation
3. Greener Transportation
4. Nature Appreciation, Conservation and Restoration
5. Green Acquisitions and Infrastructure
6. Water Resource Conservation
7. Education and Outreach.

Some of the resolutions shown above have already been fully or partially integrated into the EcoSolar House Educational platform. For example, through solar energy use and energy efficient electric appliances energy efficiency and conservation have been addressed. Making the construction of the house with eco-friendly materials also provides a background to educate people in green acquisitions and infrastructure. Also, recycling bins are already in place, and education and outreach activities have been organized to show the house to interested visitors.

In this particular proposal, one of the main goals is to address water resource conservation. The purpose is to show several ways how to conserve water and energy using sustainability techniques. This includes several projects:

- 1) Installation of an Aquaponics system – This is the combination of raising fish and plants together in one integrated system to produce sustainable food. The fish waste provides an organic food source for the growing plants and the plants provide a natural filter for the water the fish live in. As a result no fertilizers are required, the water is continually recycled rather than being lost in the soil and no pesticides or herbicides are used. The outcome is locally produced fish and plants that will give the customer the piece of mind that the food they are eating is healthy, free from pesticides and herbicides and - importantly in our changing world - has been produced using minimal amounts of fossil fuels [from <http://www.theguardian.com>]. This kind of system is an excellent educational example in how to conserve water and healthy produce food. There are several initiatives in the UPRM that are currently working in research with Aquaponics systems. Campus Verde has already begun communications with these teams to implement a simple, educational geared system at the EcoSolar house that will serve as a demonstration and educational platform. It is also expected to provide workshops in how to implement the system at home. This project was born out of the AmeriCorps federal proposal we submitted in collaboration with the Mayagüez Municipality.
- 2) Solar Energy for Aquaponics and electric car charging station – Since the Aquaponics system requires a roof, it is proposed to build this with solar panels. In this fashion the energy required to run the water pump will come from the sun, and the remaining energy will be used to install an electric car charge station, next to the solar house.
- 3) Rainwater collection system - An easy and affordable way to collect rainwater from the roof will be introduced in the EcoSolar house. There are several ways in the literature that explains how to built such a system, using blue barrels to collect the water and PVC is easy and affordable since the materials can be found in any hardware store in Puerto Rico. The students and faculty will make this an educational project and a workshop for the community will be developed. Another alternative to be explored will be to use bamboo trees instead of PVC. Bamboo plants grow without pesticides and with little water. In addition to the water collection system, it is expected to combine this project with an irrigation drip system for the gardens around the house.
- 4) Reroute gray water to trees and plants – The EcoSolar house is an educational platform of how to live in a sustainable manner, in order to provide a full educational experience, kitchen, laundry, and full bathroom is included. A simple graywater clothes washer

system will be implemented to teach the concept of reusing water. By using eco friendly detergent the washing machine, water can be diverted through a three-way water valve directly to a mulch bed in a garden. There are more complex systems if water from the sink or bathroom is desired. The house already has smart energy washing and dryer machine. Plumbing materials and labor will be required for this project.

- 5) Composting toilet systems – Commercially available toilet system will be integrated to the solar house. Since the house is a single floor unit, toilets working with gravity are not suitable. There are options such as the vacuum flush and composting toilet system combo that works with DC or AC power and is designed for small spaces. The composting treatment system is installed outside of the house and there is no need for underground tanks.
- 6) Water saving tips posters and low cost alternatives – the house will be implement common techniques for water conservation such as installing water saving aerators in all faucets, dual flush toilet, motion sensor activators, timers, etc. There will also be exhibit posters with tips on how to save water while gardening, using the bathroom, laundry, and kitchen, just to name a few.

The Eco-House, once completed will be used as an educative structure to demonstrate projects that help decrease greenhouse gas emissions in the planet and therefore showcase a low ecological impact living unit.

- It will receive visits from private and public schools from all over the island.
- The house will have a small museum of ecofriendly equipment and products, with handouts and books concerning sustainability topics related to renewable energy, organic agriculture, climate change, water and other resources conservation, pollution control, recycling, and others.
- It will also be accessible to our academic community (~16,000 students, employees, and professors).
- It will be used as base to develop graduate projects in sustainable technologies with potential collaboration from other university campuses and new environmental initiatives.
- It will be used to build an adjacent organic garden in collaboration agricultural sciences and the GBS

Students and visitors will benefit greatly from this facility where they can learn about the benefits of green buildings.