ElectroCap Project Proposal

Water Battery

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1. Advisors and Mentor

- Scientific Advisor: Prof. Duarte Mesquita e Sousa
- Scientific Co-advisor:
- Coordinator:
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2. Problem definition

When a residential photovoltaic (PV) solar panel generates surplus energy beyond the household's needs, there are two options: either selling the extra energy to the grid or storing it. The first one is less attractive due to the typically low purchasing price for energy during sunny periods. On the other hand, storing excess energy in batteries necessitates a substantial investment. Another approach involves utilizing the surplus energy for daily tasks, such as heating water in a domestic hot water tank. However, this requires implementing a distinct control model for water heating, as opposed to the conventional ones designed to keep water at a consistent temperature. The main goal is to not waste energy. For photovoltaic systems with reduced power, the energy is typically not sold to the grid. Therefore, the idea is to use this energy efficiently and avoid wastage. On the other hand, for systems with higher capacities, it is already possible to consider the option of selling excess energy to the grid.

3. Solution beneficiaries

First and foremost, it's important to note that the problem and the presented solution are targeted towards individuals who do not have domestic electric storage water heaters. We can identify various groups that directly benefit from the resolution of the problem mentioned before, such as homeowners who don’t have photovoltaic solar panels with enough capacity to be able to sell the energy excess to the grid and also homeowners that have a lot of photovoltaic solar panels.

4. Technological solution

Our project proposes an innovative technological solution to utilize surplus solar energy for water heating by developing a water tank capable of adjusting and regulating the temperature. This innovative tank will have the ability to optimize water temperature, maximizing the use of energy that would otherwise go to waste. Our system integrates a smart water heating control system, sensor technologies Sensors monitor temperature and environmental factors, providing accurate data for system adjustments. Our Water Battery project aims to overcome constraints associated with surplus solar energy utilization, offering an efficient and sustainable solution for residential water heating.

5. Competitors and previous work

We believe that our project thrives on innovation and we recognize that our competitors are focused on other ways of using the excess of energy. This includes companies specializing in advanced battery solutions as well as those involved in the development of cutting-edge water heaters, particularly in the domain of domestic electric storage water heaters. Understanding these established technologies is crucial for our project's success, allowing us to identify opportunities to make our approach stand out in the diverse market of energy storage solutions. In relation to previous work, we believe that understanding existing technologies is crucial for the development of our project. Technologies such as those used in water heaters are important, not only for the design of the tank where we will store water but also for the procedure employed in water heating. It is equally essential to capitalize on the work already undertaken in water heating control systems, as this process is fundamental for the viability of our project.

6. Solution requirements

For instance, let us consider a household network with a photovoltaic panel. At some point, in a sunny day, the energy generated will exceed the domestic consumption.

As such, part of the energy will not be used.

The focus of our project is to find a sustainable way not to waste this excess of energy.

Therefore, we propose a controlled smart system to manage the path of this part of the energy produced.

- when possible and effective, sell the energy to the external network;

- Otherwise, store the energy in a water heater and later use the heated water for daily activities.

7. Technical challenges

Once our system is implemented, it will need the intelligence and precision to decide what to do in certain cases:

- When the water heated in the tank is not used and there is no surplus energy to maintain its temperature, it will decrease, resulting in a waste of energy;
- When it is possible to inject surplus energy into the grid, and thus make a profit, but consumers need permanent use of hot water, our system will need strong optimization to face these issues.

8. Partners

The success of our project lays on cultivating strategic partnerships with collaborators such as ‘Fundicalor - Climatização e Energia Lda.’ in the energy and air conditioning sector, technology firms, energy distribution entities, and esteemed academic institutions like IST. They provide specialized expertise, shared resources, crucial feedback, and real-world testing opportunities.

9. Testing and validation metrics

Key metrics for our project include the ratio of consumed energy to produced energy (minimize delivery to grid). Energy storage capacity. Cost comparison to battery solution. Opinions of homeowners with PV systems. These metrics are essential to ensure that the system is thoroughly tested, i.e., meets quality standards, and satisfies user expectations.

10. Division of labor (I)

Team Member 1	Team Member 2	Team Member 3
Study Temperature Sensors	**Study materials to build the water tank**	**Study the control unit of PV panel**
Choose the best default temperature	Study the best materials that can resist the high temperatures	Understand how we might only use the surplus energy in our water tank heating how to redirect it
Choose the controller to implement in our system	Study the best quality-cost material	
When to use the sensor and how to it efficiently		

11. Division of labor (II)

Team Member 4	Team Member 5	Team Member 6
Study the Energy Controller attached to the water tank	**Create the WebSite and LandingPage**	**Create the WebSite and LandingPage**
Understand when and how to collect the surplus energy from the PV panel	Choose the programming language to use	Choose the programming language to use
	Structure the front end and the back end coding	Draw the front end and structure the back end coding

12. Schedule

For the deadlines, we believe we can achieve the scientific support knowledge and develop the Landing Page until the end of February (**29 of February**). All the others tasks, including implementing the controllers in the water tank and connecting it to the control unit of the PV panels, at the moment we predict we can have them all partially achieved on **1 of April**, which also corresponds to the deadline for the intermediate delivery of our project.