

The Greener Housing Coalition

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

The University of Virginia is committed to achieving carbon neutrality by 2030. However, while they have addressed almost every sector of their on-campus emissions, they have not been able to develop a plan to combat the emission of Off-Grounds housing. The Greener Housing Coalition is designed to do that. Spearheaded by a design team comprised of myself and three other students at UVA, we intend to address sustainable Off-Grounds housing by focusing on community engagement and recruitment, along with the integration of existing sustainable solutions. The background research surrounding this project will focus on the concept of carbon neutral buildings. The research question is as follows: what are the hurdles and best practices to create carbon-neutral residential buildings?

Literature Review

Critical to understanding the background of this project are a few key definitions. To begin with, we will discuss the broad concept of sustainability, which is most commonly defined as “meeting the needs of the present without compromising the ability of future generations to meet theirs” (Beattie, 2020). However, we will go beyond just a single definition and examine environmental, social, and economic sustainability. These are the three pillars of sustainability (Beattie, 2020).

- **Environmental Sustainability** – an entity’s impact on its local and global environmental surroundings.
- **Social Sustainability** – the support of an entity by its members and the members of the community it impacts.
- **Economic Sustainability** – an entity’s financial viability and responsibility.

Throughout this paper, we will consider any mention of sustainability to refer to this holistic concept. That being said, our primary focus will be on environmental sustainability. We will make extensive reference to the concept of carbon emissions. Furthermore, we will keep in mind that virtually any action can create carbon emissions, and therefore it is crucial to define the boundaries of all emissions spanned by such an action. These boundaries will be spanned by scope 1, 2, and 3 emissions (Huang, Weber, & Matthews, 2009).

- **Scope 1 Emissions** – these occur directly on property owned by an entity, such as on-site burning of fossil fuels.
- **Scope 2 Emissions** – these do not occur on-site, but are any other emissions owned by an entity, such as emissions related to purchased electricity.
- **Scope 3 Emissions** – these are any emissions motivated by an entity but are not directly owned by said entity.

Typically, individuals are only cognizant of scope 1 and 2 emissions. We will keep these, along with scope 3 emissions, in our mind as we move forward with this research. This method is a commonly excepted practice, and is a much more holistic approach than simply considering on site emissions. This example of systems thinking is crucial in the field of sustainability (Davidson & Venning, 2011). That being said, it has yet to be applied on a large scale (Davidson & Venning, 2011).

Moving forward, let us examine the need to transition to carbon neutral buildings. This topic is crucial to the transition to the clean energy future, but there are still discrepancies over best practices and how to define carbon neutral buildings (D'Agostino & Mazzarella, 2019).

Past research has already been conducted on applying the three spheres of sustainability (otherwise known as the triple-bottom-line approach) to green buildings (Gilkinson & Sexton, 2010). Furthermore, past research has shown that buildings present a unique challenge to sustainability, as older buildings require more extensive retrofits than ones created more recently (Dunphy, Boo, Dallamaggiore, & Morrissey, 2016).

For our purposes, we will identify three steps to the creation of carbon neutral buildings (Roberts, 2021):

1. **Weatherization** – reducing energy losses within a home, and therefore reducing energy consumption, can help reduce the burden on renewable energy systems
2. **Electrification** – many properties still rely on fossil-fuel burning appliances, such as ovens, stoves, and water heaters. Replacing these with electric versions eliminates scope 1 emissions from a property.
3. **Secure a Renewable Energy Source** – this final step ensures the elimination of scope 1 and 2 emissions from a property.

It is worth mentioning that the above steps are applicable to existing buildings only. The creation of new buildings represents a separate challenge, as the construction and acquisition of buildings represent a massive source of emissions.

Pivoting to the central theme of this paper, let us examine issues with university residential buildings. While many universities have plans of actions for buildings they own, there is a lack of research on how to combat the emissions of off-campus housing. Stanford University is an example of this. They have created guidelines for students to follow in order to combat their

own personal footprint, but these are not enforceable policies, and only focus on personal choices (live Cardinal Green).

Furthermore, there is the issue of split incentives. In this context, we will define split incentives as “capital improvements that yield energy savings result in one party paying for improvements while the other party receives the benefits of reduced utility costs” (CBEI). This concept is prevalent in residential buildings, as it is often the case that residents do not see the benefit of energy efficient decision-making as they are not the ones paying their utility bill. In the case that the resident is responsible for an energy bill, then the landlord may not be willing to pay for more efficient appliances, as they cannot justify the initial expense when they do not see the payoff.

Finally, let us briefly look at the scope of the problem. Around 70 percent of the roughly 25,000 students at UVA live in Off-Grounds housing (Brailsford and Dunlavey, 2013). This is a huge portion of emissions that is then out of the control of UVA, and faces all the challenges that exist when examining residential buildings.

Methodology

The methodology for the technical aspect of this project is somewhat vague, as this was not a clear-cut experimental design procedure. Furthermore, the other team members of this project are not engineering students. Due to this, we have been focusing on qualitative ideas and community engagement to tackle our design challenge. Our goal is to develop a student-led organization known as the Greener Housing Coalition. The Greener Housing Coalition would have a large student membership, and would collaborate with outside organizations and

businesses to implement sustainable solutions on a large scale, rather than the level of personal decision-making.

The following bullet points are the best way to describe our methods:

- **Secure Funding** – the means exist to create carbon-neutral residential buildings, the issue is the cost to the average consumer. If the Greener Housing Coalition wants to succeed, we need to secure funding to implement changes in Off-Grounds housing. This way, the cost does not fall to the average student.
- **Focus on the People** – as stated, the technology exists to create carbon-neutral buildings. Our job is not to invent a new solution, but to recruit and empower as many students and/or people to adopt sustainable practices.
- **Integration of Best Practices** – through research and conversations with industry experts, we have been working to identify the most effective means to reduce the carbon footprint of Off-Grounds Housing. We hope to integrate these means within the homes of as many students as possible.
- **Structured Flexibility** – we are working on designing an organization that has both clear-cut roles and goals, and the ability to adopt and change its methods as newer and better solutions arise.
- **Clear Understanding of the End Goal** – the actions of the Greener Housing Coalition should always be centered around the transition to Carbon-Neutral Off-Grounds Housing

Body

The Greener Housing Coalition conducted an initial body of research on the best practices for improving the sustainability of residential buildings. Through these efforts, we came up with a list of potential efforts to implement in Off-Grounds housing:

- **Energy Audits** – these are a simple, effective way to determine the relative footprint of a residential unit.
- **Lighting Efficiency** – we believe a majority of Off-Grounds housing units still utilize incandescent bulbs for a majority of lighting needs. Replacing these bulbs with more efficient option such as LED bulbs is a quick and easy way to reduce the overall energy use of the system.
- **Programmable Thermostats** – these can reduce the HVAC load on an apartment, providing immediate energy returns.
- **Weather Stripping** – sealing the cracks around doors and windows prevent wasted energy from escaping homes.
- **Replacing Fossil-Fuel Burning Appliances** – in order to achieve carbon neutral Off-Grounds housing, any scope 1 emissions must be eliminated. All appliances must be electric
- **Recycling Initiatives** – Many Off-Grounds housing units do not have separate recycling disposal units.

Throughout the initial stages of this project, we talked extensively with the Local Energy Alliance Program, which is “a nonprofit that matches you with the best programs, contractors, and financing options available in your area. You get valuable home upgrades like energy efficiency and solar panels – customized to your needs and budget” (www.leap-va.org). LEAP indicated to us that if we were to bring them students, they could utilize a program created by

Dominion Energy to provide free energy audits and energy efficiency upgrades. The qualifications for the program were that households had to be below \$60,000 per year in total income, which almost all students are well beneath.

And so, throughout the Fall 2020 semester, the Greener Housing Coalition operated under the assumption that we would be partnering with LEAP. We therefore centered our efforts around the recruitment of students, who we would then bring to LEAP to do two things:

- **Schedule Audits** – as stated before, we can use energy audits as a way to measure and identify sources of emissions in residential units.
- **Utilize Funding to Make Upgrades** – the fact that LEAP could implement changes (such as efficient lighting and weatherization) for free took away the problem of split incentives.

As our team delved into research, we decided we would need to create some sort of organization to handle a large volume of student members. This organization would have the following components:

- **Student Members** – we want to see a significant portion of the UVA student population involved with this organization.
- **Student Leaders** – a small group of dedicated students would lead the efforts of the Greener Housing Coalition
- **Student Professional Internships** – the Greener Housing Coalition would hire students with necessary skillsets to carry out professional initiatives, such as the development of a website or generation of sustainability reports. The difference between this position and

the student leaders would be that the internships would be a much more time and effort intensive position.

- **Professional Board of Directors** – we have had conversations with multiple professors and faculty members at UVA about the potential for them to oversee the actions of the Greener Housing Coalition. This would ensure we are including industry experts in the efforts to decarbonize Off-Grounds Housing

All of this was coming together smoothly, but we ran into a hurdle early in this semester. I and my other teammates were working with LEAP to schedule energy audits of our own housing units as a way to test out the process. It was at this point that LEAP realized that students do not actually qualify for the grant from Dominion Energy. Our source of funding was gone.

That being said, not all is lost. We are currently in the process of applying for the University of Virginia Environment and Equity fund. This could lead to up to \$5,000 in funding to utilize to improve the sustainability of Off-Grounds housing. If we do not qualify for this funding, we will continue to search for financial opportunities.

We had always intended for the Greener Housing Coalition to be an autonomous organization. Connecting ourselves entirely to someone like LEAP can create the potential for roadblocks, as was shown through this process.

Moving forward, the Greener Housing Coalition will focus on the following initiatives:

- **Member Recruitment** – the one thing that has not changed is the need for large numbers of students to be involved in this project. We are developing a marketing and recruitment campaign to get students to join the Greener Housing Coalition.

- **Low-Cost Energy Efficiency Upgrades** – we are going to try to get as many low-cost upgrades into student housing units as possible. Once we secure funding, we plan to start with energy efficient lighting.
- **Organization Structure** – we are still developing the format for the organization, but we plan to stick the structure outlined above, with student members, student leaders, student professional internships and a professional board of directors.
- **Plan for Larger Initiatives** – the more funding we are able to secure, the more potential there is for larger initiatives. If significant funding is secured, we hope to be able to ensure the electrification of Off-Grounds housing.

Conclusion

The Greener Housing Coalition showcases the problems with the field of residential building sustainability. It has been extremely difficult to gain traction, as even conversations with industry experts leave us wondering what the best solutions are.

But we will continue to move forward. Off-Grounds housing represents a significant threat the goals of the University of Virginia, and without significant student engagement, it is unlikely that any long-lasting changes will be implemented.

Citations

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