Sustainable Design Thinking Final Assignment

Report and Recommend

Addressing a Challenge Via Design Thinking:

Off-Grounds Housing Emissions at the University of Virginia

By the UVA Greener Housing Coalition

Spring Semester: Dylan Cudahy, Bryce Forys, Luca Pfeiffer, and Annabelle Swift

Fall Semester: Oliver Gerbig, Emma Stovall, and David Veltri

About the Greener Housing Coalition

The Greener Housing Coalition is an organization started at the University of Virginia in 2020, as a student effort aiming to reduce housing emissions beyond dorms and university housing. The student-oriented group is multi-disciplinary, with students studying engineering, policy, and sustainability.

Acknowledgement

This report was supported by advising from Professor James Groves at the University of Virginia. The work was a cumulative effort that included the participation of UVA students Oliver Gerbig, Emma Stovall, and David Veltri during fall of 2020. The GHC is especially grateful for the continued support of the UVA Office for Sustainability. However, these reviews and support do not imply any endorsement, and any errors are the authors' own.

Contact Information

UVA Greener Housing Coalition
Charlottesville, VA 22903
cvilleghc@gmail.com I @cvilleghc on Instagram

Table of Contents

Executive summary 3

Challenge space definition 4

Mission statement 10

Generation and selection of requirement-based design concepts 11

Design concept exploration..... 41

Design in detail 88

Reflections on design thinking 103

References 111

Appendix 126

Executive Summary

The Greener Housing Coalition is an organization dedicated to reducing the carbon and energy footprints of off-grounds housing at the University of Virginia. The project began in the Fall of 2020, where our team worked to develop a picture of the challenge space. Through estimation and back-of-the-envelope calculation, we discovered that off-grounds housing has an energy footprint comparable to that of the University at large.

Furthermore, research and consultation with experts has uncovered numerous roadblocks. The split incentives between renters and landlords leaves little room to address the problem. The wide range of housing complexes and ownership makes finding responsible consumers complicated. And finally, the large upfront costs of significant energy reducing improvements are not financially available to the average UVA student.

To address these issues, our team examined different solution concepts focused on building sustainability. Through research and conversation with experts, it became clear that we needed a solution focused on community engagement, rather than a specific technology or innovation. This led us to the idea of a non-profit organization (this would later manifest into a Contracted Independent Organization), where students at UVA would constitute the membership, and partnerships with local businesses would allow for energy audits and retrofits.

Such an organization would allow us to educate and empower our peers to implement change. Through acquisition of funding and partnerships with specialist organizations, we could bring the most up-to-date solutions to tackle the problem. Rather than working with one living space at a time, we could implement effective changes on a much larger scale.

The design thinking process showed us that sources of funding and partnerships will shift throughout the lifecycle of the Greener Housing Coalition. Our initial partnerships and sources of funding are no longer an option, and so we will continue to search for additional sources. But even without monetary support, the Greener Housing Coalition will promote awareness of the severity and scope of sustainable living. Furthermore, we will be able to collect information that could aid future efforts to reduce off-grounds housing emissionsAt the very least, we will have engaged a wide range of stakeholders to work together toward a commendable common goal.

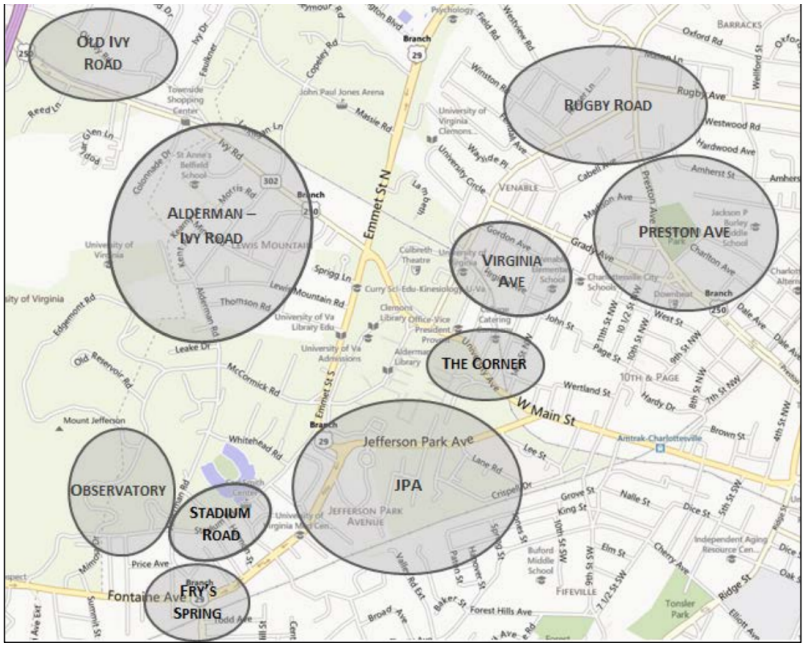
Challenge Space Definition

Challenge Space Overview

Off-Grounds housing is unsustainable and unlikely to be improved without action. Split incentives, lack of information, and perceived and actual costs are all salient factors that contribute to unsustainable housing.

Significance of Challenge

While the University of Virginia has many significant climate pledges to reduce emissions, they are unable to make improvements to student residences off-Grounds. As such, their goals ignore these scope 3 emissions and are not comprehensive (*UVA Greenhouse Gas Action Plan*). These emissions are significant. 70 percent of UVA students do not live in University housing ("University of Virginia; Student Housing Analysis Study," pg 15).



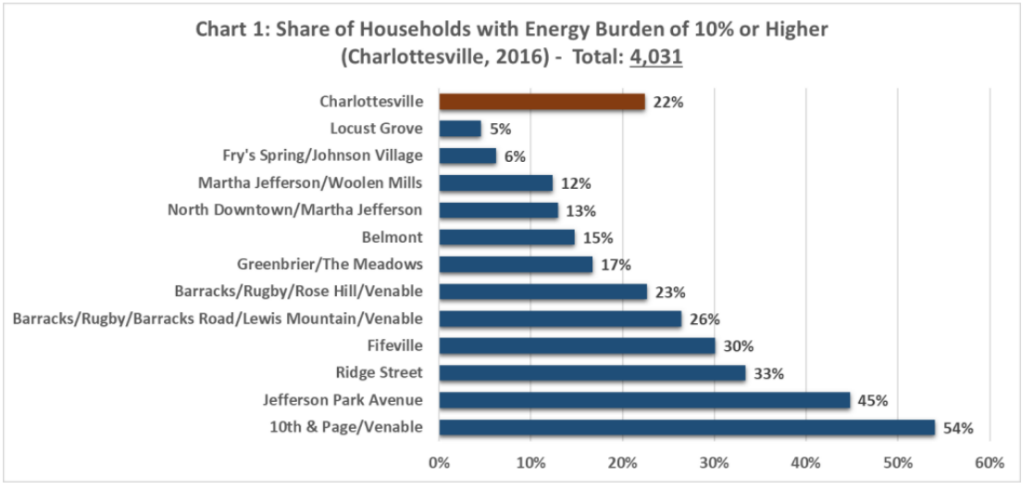
Source:
https://officearchitect.virginia.edu/pdfs/UVAPhase_I_Documentation-BriefingMemo.pdf

Based on our estimations, off-grounds housing at UVA is responsible for 260 million kilowatt hours of electricity, and 180,000 metric tons of CO2 equivalent every year. Below is a graph charting the emissions of UVA over a period of 10 years. These statistics do not include the emissions of off-grounds housing. Adding off-grounds housing as a component of UVA's emissions would cause a 50 to 60 percent increase.

Source: "Climate Action & Energy." *UVA Sustainability*, University of Virginia, sustainability.virginia.edu/steward/climate-action-energy.

Energy usage is both an environmental and financial challenge. In Charlottesville, 4,852 households have high to extremely high energy burdens, spending between 6% and 20% of their income on energy consumption ("Uncovering Energy Inequity; Executive Summary" 2). These high energy burdened households are concentrated in specific neighborhoods across Charlottesville, including 10th & Page/Vennable and Jefferson Park Avenue ("Uncovering" 3). Students, who make up a large portion of renters in Charlottesville, are also impacted by this inequity. In fact, student-dominated areas such as Barrack/Rugby/Rose Hill/Venable, 10th & Page/Venable, and JPA, make up 47% of high energy burdened households ("Uncovering" 4).

Energy burdens disproportionately affect renters, who unsurprisingly make up a majority of the residents in the areas mentioned above. Renters take on two times the energy burden of their home-owning peers ("Uncovering" 4). On average, students pay between $400 and $599 for monthly rent off grounds ("University" 27). When not included in the standard rate, most students pay between $50 and $99 on utilities monthly ("University" 28).



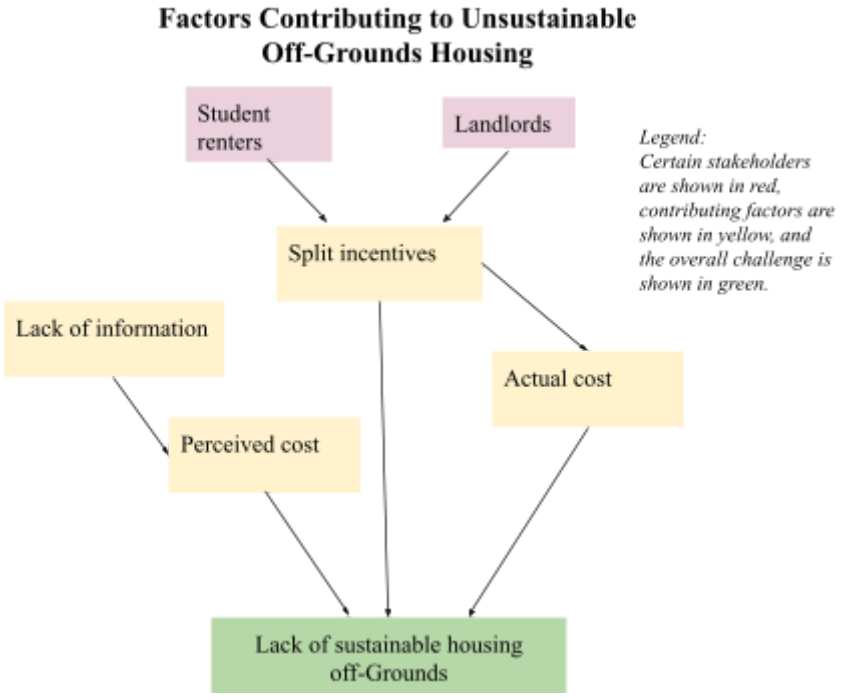
Source: Charlottesville Climate Collaborative, “Uncovering Energy Inequity,” Executive Summary, July 2020.

Services from the city of Charlottesville and county of Albemarle are not easily accessible for students. Two third of emissions in Charlottesville are attributed to residential and commercial buildings (McGowarn, 2019). Broadly outlined goals and pilot programs fail to incorporate the student population and renters more broadly. Similarly, the nonprofit Local Energy Alliance Program (LEAP) has failed to tap into the student market. There is a lack of communication regarding what LEAP is and what services they can provide. Both landlords and students are unaware of how LEAP can help improve the energy usage of their home’s. Through weatherization programs and energy education resources, LEAP could be utilized to improve the efficiency of a large portion of the off campus student housing stock.

Challenge Space Details

Students are also unlikely to engage in sustainable housing practices. A residence becomes more sustainable when it requires less non-renewable resources to condition and operate the systems within the home. This can be achieved through increased energy efficiency, electrification, or renewable energy.

There are various factors contributing to the unsustainable off-Grounds housing stock. First, it is a critical issue that residents lack knowledge about sustainable housing practices. In addition, sustainable improvements can be a significant financial investment, especially for college students. Finally, many actions and resources require active participation from landlords. Some of the stakeholders and factors are shown below, listed in order of priority.



Split Incentives

While many sustainable solutions will pay for themselves overtime, often the payback period is greater than the length of time a college student will inhabit a living space. Furthermore, many housing units will include utilities as part of the rent. These two factors deplete the financial incentive for students to make the changes themselves. On the other hand are landlords, who likewise experience the financial burden of utilities. However, the high demand for living space in Charlottesville leaves little incentive for landlords to invest in expensive renovations. This split incentive leads to a lack of sustainability housing off-Grounds, and raises the actual costs for many stakeholders.

Perceived and Actual Costs

Most college students assume that in order to make their residence energy efficient they need to spend a fortune. However this could not be further from the truth. In fact, if a resident meets certain criteria, making their home more sustainable could be free, through programs such as LEAP. Additionally, through energy education college students in off campus housing could make their homes more efficient and save money on utilities by applying more efficient daily habits.

Lack of Information

Coming out of first year housing on Grounds, the majority of students have very limited knowledge of not only what contributes to sustainable housing, but also of what the norm is for utility bills and energy expenditures. Many students are not coming from a home with tools that make energy use more efficient, like programmable thermostats or better insulation, and do not know to be looking for these things when choosing where to live next. The majority of students have also never paid their own rent and do not know what is high or low for a utility bill, making it harder to know if they are paying too much for their energy.

Limited Time

The average UVA course load is 15 credits. This translates to a workweek of over 45 hours. Students are also involved in clubs and many hold part-time jobs, which are typically limited to 20 hours a week to acknowledge the time burden of academics. However, there are no limitations for students who choose to work off-Grounds. We expect that time constraints are one factor among many that limit students from making their housing more sustainable, especially when coupled with the limited information discussed above. The more time investment is required, the less we predict we will be able to rely on student involvement.

Stakeholders are Disconnected

Another final reason this challenge space is significant and unlikely to change is because the stakeholders are unconnected. The diagram below shows the many resources within UVA that largely affect on-Grounds housing, compared to the resources in Charlottesville and Albemarle which students are unaware of.

We can be confident that this challenge space is significant given feedback from stakeholders. Notably, On October 16, 2020, two Charlottesville City employees - Terri and Kristel - reiterated that there is a gap in what the city is able to do for sustainable housing off-Grounds, especially given that students rotate through and are therefore very difficult citizens to engage with. In addition, they spoke to the lack of affordable housing in Charlottesville and how that high demand reduces how responsive landlords are to renters. Finally, they provided a list of resources from the city that they can offer to help our coalition, but which students are not currently aware of.

We are confident that we understand the factors contributing to this problem and are excited to be working in this challenge space.

Mission Statement

★ To recruit, empower, and educate our peers to improve the sustainability of their housing. We strive to make sustainable decision-making the norm at the University of Virginia. In the long-term, we aim to serve as an example of the universal attainability of affordable, sustainable housing.

Generation and Selection of Requirements-Based Design Concept

Requirements, Metrics and Specifications

I. Product requirements

We began with four requirements. Given that we aim to address the problem of split incentives with off-Grounds housing emissions, we require a solution that satisfies multi-faceted requirements and must be:

- Sustainable,
- Able to generate student involvement and be equitable,
- Able to ensure landlord support,
- Durable.

We broke down these requirement categories further and ranked the importance of each category, as well as the possible ways to measure them.

Table 1: Sustainability Metrics

Requirement	Importance	Qualitative Value	Quantitative Measures
Reduces residential emissions from off-Grounds housing	5	This is the key to addressing our problem statement; if we cannot impact emissions, we will have failed to solve our problem.	Average tons of CO2 emissions saved per house * number of houses involved. Percentage reductions each year out of total off-Grounds housing emissions. Complete reduction by a certain year.
Does not create more waste and emissions	2	The fewer emissions our solution generates, the more we hold to our principle of valuing	Average CO2 emissions generated each year. Could impose a strict ceiling of maximum emissions per year.

		sustainability.	Could require declining emissions over time.

Table 2: Student Involvement and Equity

Requirement	**Importance**	**Qualitative Value**	**Quantitative Measures**
Affordability	4	Affordability is a key characteristic of our solution.	Limit on spending required of any person involved. Goal of an average spending under a threshold. Return on investment requirements.
Equity	3	Demographic make-up of those who interact with our solution; attractiveness of our solution to a variety of groups.	Socio-economic diversity. Racial diversity. Gender diversity.
Accessibility	4	General ease of which a college student could use our solution concept.	Maximum time of investment required by students. Average investment time required by students. Efficiency or return on investment of time and money.

Table 3: Landlord Support

Requirement	**Importance**	**Qualitative Value**	**Quantitative Measures**
Landlord support and/or engagement	4	This condition is almost necessary. While some greener housing changes can be made without landlord support, avoiding opposition is critical and support will enable much greater reductions in emissions.	Percent of landlords involved/supportive. Amount landlords are willing to spend on improvements. Time landlords are willing to give for improvements. Time spent communicating with landlords.

Table 4: Durability/Longevity

Requirement	Importance	Qualitative Value	Quantitative Measures
Undergraduate student engagement	5	This is a necessary requirement; without undergraduate student engagement, no solution will be durable.	Number of students on the ListServ. Number of students attending events. Number of students who recognize the GHC name. Percent of students engaged. Retention rate of students each year. Recruitment rate of new students each year. Number of student groups partners. Length and intensity of commitment of said groups.
Financial support generated	2	Sustained or sufficient financial support will allow the project to continue without concern of going insolvent. However, it is not a necessary condition, as the solution may not require much funding.	$ raised per year. Number of donors per year. Declining average spending each year. Increasing funds raised each year. Number of recurring donations. Grants received. Funding provided by partner organizations. Funding provided by UVA.
Institutional support (UVA)	2	Continued interaction and communication between administration and those working for UVA and the Greener Housing Coalition.	Financial support from UVA. Number of meetings attended by UVA admin. Number of instances in which UVA promoted or voiced their support of the Greener Housing Coalition.

These rankings led to a condensed list of critical metrics that would be applied to our solution concepts.

II. Metrics and preliminary specifications

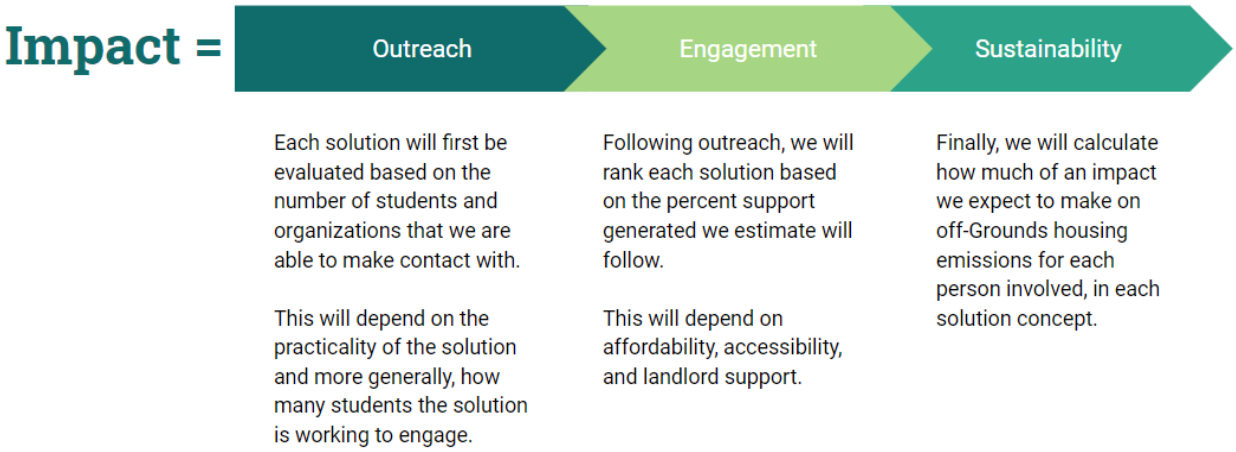
The following table outlines the acceptable and ideal goals we have for a solution concept. Ultimately, we will be acting in line with the University of Virginia's and Charlottesville's goal of carbon neutrality by 2030.

Table 5: Metrics and Preliminary Specifications

Metric	**Quantitative Measurement**	**Acceptable Value**	**Ideal Value**
Practicality	Time and effort required to make the solution effective	3 hours total	1 hour total
Outreach	***Number of students***	1000	17,000 (all off-Grounds)
Affordability	Potential financial savings by students and landlords	25%	30%
Accessibility	Ease of use/access to the solution (ranked 1 to 5, 5 being the most accessible solution possible)	3	5
Landlord support	Percent of landlords involved who are supportive	75%	100%
Engagement or Uptake	***Average expected level of engagement*** Function of affordability, accessibility, and landlord support	100	1000
Sustainability	***Average emission reductions per person***	50%	100% (this would involve extensive work with the electric grid to accelerate the adoption of renewable energy)
Impact	= outreach * engagement * reductions = total reduction of off-grounds housing footprint	30%	100%

Overall, we will be measuring the success of our solution by the extent to which it is **impactful**. We will determine this by its ability to accomplish outreach, engagement, and

sustainability. We believe this is important because a solution concept needs to do all three to be successful. For example, solutions can very effectively reduce carbon emissions, however, if it does not reach very many students it still is not effective. We will calculate this using the following equation.



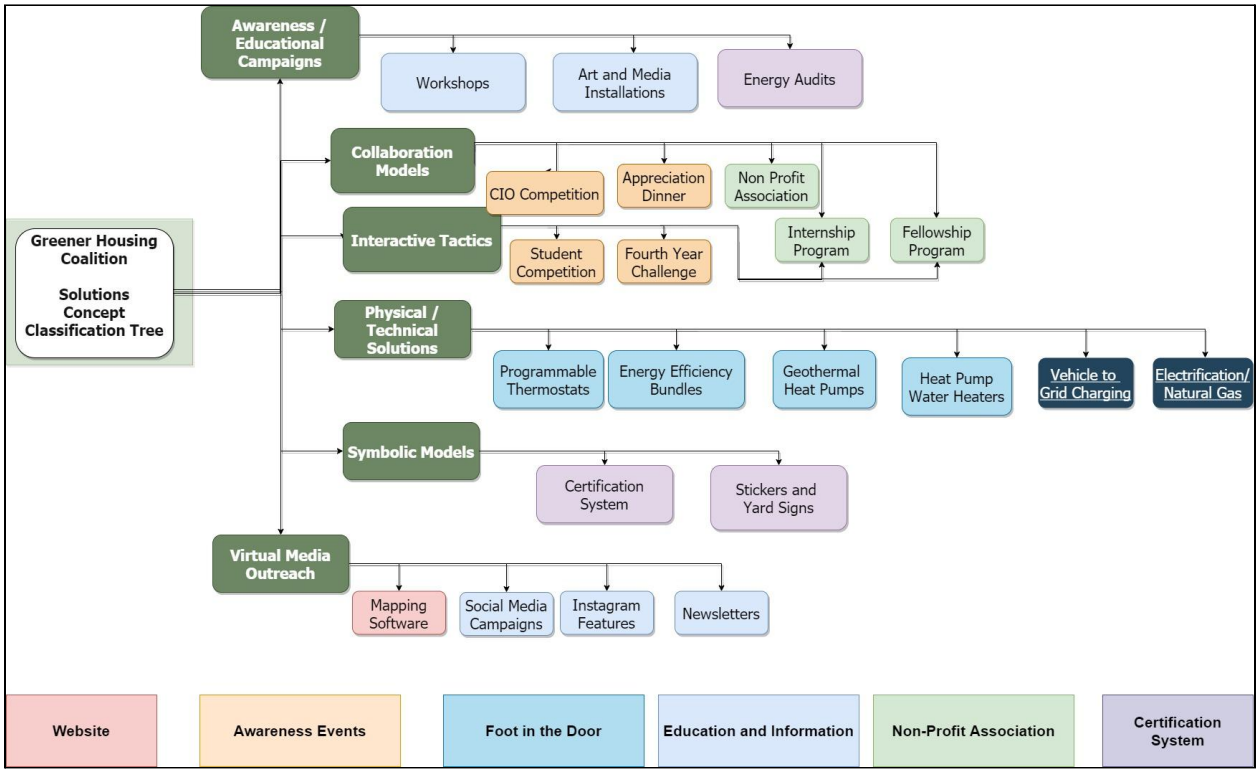
Impact = *Number of students* * *Average expected level of engagement* * *Average emission reductions per person*

Most Promising Design Ideas

Narrowing down solution ideas

All of our solution concepts became grouped into our six most promising design ideas, shown below with the color-coordinated boxes.

Solution Concepts Classification Tree



This process is explained by the following table, which connects the solution concepts to the solution fragments.

Solution Concept	**Solution Fragments that make it up**	**Why Grouped Together**
Website	Mapping Software	We thought this solution concept had a lot of potential standing alone and should be evaluated separately.
Awareness Events	CIO Competition Appreciation Dinner Student Competition Fourth Year Challenge	We combined these fragments to define a solution concept that works to increase overall awareness about energy efficiency of off-grounds student housing- utilizing both general awareness events and events

		that work to get students engaged using incentives like competition and food.
Foot in the Door	Programmable Thermostats Energy Efficiency Bundles Geothermal Heat Pumps Heat Pump Water Heaters	This solution concept combines many smaller technical solution fragments in a “foot-in-the-door” strategy to allow smaller energy-efficiency changes students make to grow steadily to larger, more impactful alterations.
Education and Information	Workshops Art and Media Installations Social Media Campaigns Instagram Features Newsletters	This combines all our solution fragments that sought to educate our audience about our mission through our solution fragments that gave us a virtual means of doing this.
Non Profit Association	Non Profit Association Internship Program Fellowship Program	This solution concept includes various ways to foster a network of students and partner agencies that work together to make off-grounds student housing more sustainable.
Certification System	Certification System Stickers and Yard Signs	This solution concepts combines the symbolic solution fragments to allow the Greener Housing Coalition to make it apparent what houses it has helped are more energy efficient.

Description of the solution ideas

Website

A website is very important for marketing, and can be the main resource for information. For us it is important to use it as a database and an education space for people interested with different tabs on the website. With information, contacts and reviews being the main ones. The importance of a website by Profit works says that “93% of business decisions starting with a search engine search that means if you don't have a website, you are only selling to 7% of your market.” Even though we aren’t technically a business, this still applies to the reach we desire to achieve and how important it is for us to market ourselves properly in order to bring awareness in the community.

Having a website can be used as a very important tool for us to expand awareness and to create a platform where students can access vital information. With all this information being in one place, it makes it very accessible to reach the information. Especially this day in age where technology is almost a must especially in a college student during Covid-19 times. Having access to Wi-Fi on a college campus is a given, which makes a website accessible. The only issue is how we can reach our focus group and make sure that they aren’t ignoring the resources provided. Thrive Hive has given different ways to be able to get the word of the website out there, and that is by “advertising through social media accounts, using email marketing, using landing pages etc.” these are all great techniques to get the website link out there. The only issue is, we do not want to overdo it in order to create a negative response where our focus group finds these techniques pestering and annoying. The last thing we would want is for our informational resources and emails to be put into a spam folder or for our focus group to unsubscribe from our content.

As for the affordability portion, a website is very cheap to build and maintain. There are many different options in regards to building a website, it is possible to buy a domain or to use a cheaper option which will be sufficient for what we are trying to achieve. That is to use a pre made website. Websitebuilderexpert says that option of a “free website templates from DIY website builders Wix and Squarespace.” Can be a good option for us as we do not need an extravagant website, ours will be relatively basic with just the necessary information and attributes. The cost to maintain “with these builders, costs a minimum of $12 to $13 per month to build an ad-free website.” Which is very affordable and is worth the investment to have a platform for all the important information and resources for people who are interested.

The website will consist of information regarding becoming more sustainable, energy efficient and be a database of important resources. There will be a portion of the website with contact information regarding organizations and groups that are knowledgeable and are professionals in this field, there will also be information on rebates and tips on how to

become more energy efficient at a discounted cost. An important part of the website will be reviews from people that have gone through us in order to better their living spaces. These will be real reviews and will be a very important aspect in marketing for us. Digitaltwentyfour states that “online reviews are crucial for your business’s reputation. They’re also widely influential in encouraging people along the path to purchase” now we may not be selling a product or are a business but this applies to people interested in making their living space more energy efficient and sustainable, seeing real reviews of it being beneficial can ensure them making the change. A review is very powerful and shows real life examples of it working.

Even though the website itself will not reduce emissions, it will indirectly help as a resource for people to educate themselves and become more knowledgeable in regards to making their living spaces more sustainable and energy efficient. Just because a website itself will not create reductions in emissions does not mean it cannot be a solution concept, it is still a vital resource on the path to reducing emissions.

This was a favorite solution concept from some of our stakeholders. Cyndie Goldson, a fourth year student and OFS employee wrote: “I think that overall this is the best solution as it stands. In my opinion, it would also need to be accompanied with periodic pushes through events in order to raise awareness about the resource. Websites combine accessibility with longevity and are generally a great tool to centralize efforts. The quiz is a wonderful idea because it will help people to bring the issue back down to them and see that it is indeed feasible for them (or not). Seeing testimonials is awesome, and essentially this encompasses the widest variety of values, goals, and incentives from what I can tell. The hardest part is upkeep, so it would be good to think about the structures in place to make sure that this website stays up to date.

Awareness & Events

The aim of events will be to connect students with organizations to reduce their off-Grounds housing emissions. Possible events include a formal appreciation dinner, competitions between CIOs and houses, and a challenge for Fourth-years.

A large component of success in this solution will be advertising and raising awareness for the events in order to get lots of participants. It is notable that our experience in hosting an event this year was unsuccessful. We partnered with the UVA Office for Sustainability to host a virtual focus group, and despite advertising that participating would enter students into a drawing for a prize, we did not have any participants.

In a year with less COVID-19 risk, the tools we could use for advertising are tabling, flyering and posters in popular places on Grounds. Taking the COVID reality into account, advertising for events will largely be on social media, through channels with large audiences (from OFS to the Cavalier Daily), and at organized events such as the activities fair.

Another way to increase the success of an event would be to co-sponsor. This has been a successful model for other organizations at UVA. The “4th year 5K” has developed into an annual tradition, with a third of fourth-years participating in 2015 (Winthrop, 2015). The annual Pancakes for Parkinson's event has extremely high levels of participation and has raised over $80 million since 2006 (Kelly, 2018).

A more analogous case study may be the home energy challenge from the Community Climate Collaborative. They had 434 homes participating since March of 2020, achieving almost 600 tons of CO2 reductions (“Home Energy Challenge”).

To promote the event, we could also submit an event through the UVA website, here. However, this is limited to approved units and programs. This is another way to co-host, with an office, center, or department. We have organized the following table to show the possible partners with which we could organize events, their outreach capabilities, and whether they are likely to support us.

Cyndie commented the following on the viability of the awareness/events model: “I like the idea of targeting first years, though I think that webinars are tricky. Perhaps a video would be better seeing that students would be able to access this on their own time. This would also help somewhat with longevity if the video was made well and did not mention years or dates or anything but rather things like "Check on this page for the most current partners who are helping to complete these audits." The focus on sustainable resources will get some folks, though a focus on general money saving and essentially a guide to how to move off-grounds would get more. Of course tidbits about how this impacts emissions could be thrown in there, but the resource that goes out to the general student body should not necessarily be about educating on sustainability issues. A lot of time there is also awareness of the impacts of what one is doing, but actual implementation/behavior change is an entirely different beast.”

Foot in the Door

In this solution we aim to build a step system that gradually has greater tasks of the consumer in order to weatherise and create a more sustainable home. For example, the first task may be to reduce your water usage and simply limit the amount of time you spend in the shower. A more advanced task may be to install a programmable thermostat and allow LEAP to come to your home and give an audit. The goal of this solution is to get the homeowner more intune with their home and be aware of the energy they are using.

Several metrics are important to the task involved in “Foot in the Door” solution. There are six metrics involved; degree of sustainability, affordability, CO2 reduction, practicality, landlord support, and return on investment (ROI). We evaluated the following tasks on these metrics, the summary of which is given below.

Task 1 - Behavioral modifications to Water Usage

These modifications include, but are not limited to turning off the faucet when you brush your teeth, taking shorter and colder showers, checking for leaks. This is the cheapest and most plausible task of the program. In order to do this all it takes is a little commitment.

A shower uses approximately 2.5 gallons of hot water a minute. The average shower is eight minutes long, that means that 20 gallons of hot water are used per shower. The water in a water heater is typically 120 degrees fahrenheit (Howard Perlman). Cold water is normally 55 degrees fahrenheit. This means that the temperature needs to rise roughly 65 degrees fahrenheit per shower. It requires 8.833btu to raise the temperature of one gallon of water one degree fahrenheit. Therefore to raise the temperature 65 degrees fahrenheit it requires 540btu per gallon. There are 1.17*10^-4 pounds of CO2 per BTU (Carbon and Usage Calculation Methods). This translates to .063 pounds of CO2 produced to raise the temperature of a gallon of water. Therefore if the average shower uses 20 gallons of hot water it produces 1.26 pounds of CO2 emissions. This is roughly 460 pounds of CO2 produced a year from showering (Key Water Heating Charts: Plumbing Perspective). The UVA undergrad population is roughly 17,000 students, meaning that they produce around 7.8millions pounds of CO2 emissions per year through their showers. If the UVA student body were to change their habits they could potentially cut those emissions in half, reducing their CO2 emissions by as much as nearly 4 million pounds (*U.S. Energy Information Administration (EIA)*).

Task 2 - Installing LED Light Bulbs

Unlike most tasks you may want to do in your rented home replacing a lightbulb is the homeowners choice and doesn't require a landlords approval. LED bulbs are incredibly efficient and are low energy users. LED's last longer than the average incandescent or incandescent bulbs. Incandescent bulbs have about a 1000 hour life whereas a LED has a lifespan of roughly 7,000 hours. A 60 watt equivalent uses about 9 watts to function whereas an incandescent 60 watt bulb requires 60watts.

The average 60 watt equivalent LED light bulb cost about $1-2/bulb. LED bulbs use a sixth of the energy of an incandescent they cost a sixth of the cost. LED bulbs can possibly save $42 per bulb over the life of a LED bulb (Energy- and Cost-Savings Calculators for Energy-Efficient Products). The owner of an LED bulb can make their money back in one month.

According to Boston university if everyone in the U.S was to install just one LED bulb it would be equivalent to removing the greenhouse gas emissions of 800,000 cars. If all 17,000 undergrad students were to replace just one LED bulb they would save 867 kilowatts per hour.

Task 3 - Receiving an Energy Audit

Through LEAP, students can qualify for a free energy audit to their home. Those who don't qualify can get a home energy audit through LEAP for $50, which is a significant discount from the market value (LEAP: The Local Energy Alliance Program).

An energy audit in and of itself is not a direct source of CO2 reductions. However, a main component of an energy audit is what the industry refers to as energy education. Energy education involves teaching the resident about how they can reduce their energy consumption through small changes in their behaviors and habits. In addition, most energy audits will install led bulbs and replace shower heads. Depending on your qualifications you may be getting all of that for free or at the cost of $50. This low amount of investment would have an almost immediate return on investment.

Landlords can sometimes be an obstacle. But most if not all energy companies will reach out to landlords and explain what it is an energy audit is doing.

Task 4 - Installing a Smart Thermostat

Smart thermostats are a device in the household that has revolutionised the way that people interact with their HVAC systems. Programmable thermostats are capable of learning the homeowners schedule and heating and cooling the house accordingly. Most programmable thermostats cost somewhere between $100-$200, and this can reduce heating and cooling energy consumption by as much as 10% annually. This translates into a 10%reduction on CO2 emissions that come from heating and cooling.

Installing a smart or programmable thermostat takes a little technical savviness and requires wiring the new device to existing low voltage thermostat wires. This is a job that is best left to a trained professional, although with technical support and step-by-step video instructions most homeowners could self install. Upon installation the owner will need to connect the new device to their wifi network and then link the smart thermostat to their mobile device via a mobile application.

The installation of a smart thermostat could be somewhat problematic in an apartment setting. However, programmable thermostats can be uninstalled just as easily as installment. In the setting of a home smart thermostats are a great asset. Programmable thermostats have the ability to lower the energy consumption of a household by 10%.

Task 5 - Install Heat Pump Water Heater

Heat pump water heaters are three times as efficient as regular water heaters. They do not generate heat, they move it. They extract heat from the air around them. On average heat pump water heaters live around 12-15 years. Conventional water heaters usually only function properly for 8-12 years.

A heat pump water heater itself cost on average about $700. Including installation of heat pump water eaters the cumulative cost would be around $2000. The reason cost is so

expensive is because of plumbers rates. Over a 15 year period the savings of a heat pump water heater compared to a standard electric resistance water heater would be around $1,500. A standard water heater costs around $900 to install. The difference in installation costs is roughly $1100. This means that upgrading to a Heat Pump Water heater over a standard would have an ROI of around $400 over the life of the new unit (Energy- and Cost-Savings Calculators for Energy-Efficient Products)

The average household and apartement uses 20-35 gallons of hot water a day. Studies show a 52% savings in kilowatts. A single occupant home could save as much as 431 kilowatts per year. In the case of a three person home the occupants could save 1305 kilowatts a year. In terms of CO2 potentially 400 - 1,300 pounds of C02 could be eliminated per year. Over a 15 yer life span heat pump water heaters have the capacity to remove 6000 - 19,500 pounds of CO2 when compared to standard electric resistant water heaters (Sacramento Municipal Utility District Heat Pump Water Heater Field Testing Report).

The process of installing a heat pump water heater is more challenging than one might expect. The installment is possible to be done without a specialist but not recommended. Both physically and intellectual the installment is demanding. In addition the heat pump water heaters need 1000 cubic feet of air in order to function properly. Heat pump water heaters also need to be stationed in an area that maintains a temperature between 40 and 90 degrees. The installment of a heat pump water heater will certainly need to be checked with a landlord. Based on the efficiency and longevity of heat pumps water heaters any wise landlord would approve the transition.

Task 6 - Install Geothermal Heat Pump

Geothermal heat pumps are built to last 25-50 years. They are designed to move heat from one place to another rather than generating heating and cooling. This is the most sustainable way to provide space heating. Utilizing the constant temperatures of the ground makes them much more efficient than air source heat pumps. Studies show that CO2 reduction ranges from 15-70%, meaning that in the least sustainable settings geothermal heat pumps can decrease CO2 production by 15% (Blum, Philipp, et al.).

Geothermal heat pumps are a rather expensive investment. On average they cost $12,000 post installment. Typically there is about a 12% return on investment year after year. Therefore in about 8 years it'll have paid for itself. Without any substitutes or incentives landlord support is very impractical. The only time installation of a GTHP would be a possible consideration for a landlord is when an existing system fails and is due for a full replacement. Even then, it would be a substantially higher investment than a typical system. Although a geothermal heat pump is one of the best options for improving efficiency, it would be a difficult option for most landlords to consider.

Task 7 - Installing Solar Panels

Solar panels have an endless supply of power as they draw their energy from the sun. Solar panels are known to have a relatively long life span, 25-30 years. Price regarding solar panels varies. Programs like LEAP have programs that can make solar panels more affordable. However even with these financial programs they are still upwards of $10,000.

Each kilowatt of electricity produced by solar accounts for 6 grams of CO2. Whereas fossil fuels are all well above 70 grams, with coal producing 110g of CO2/kWh. This means that solar energy produces nearly 20 times less CO2 emissions than electricity produced by coal.

For college housing solar panels are not very practical. However it is not something to rule out. The world is continuously moving toward solar oriented energy. Encouraging landlords to invest in green energy is worthy use of resources, as any system installed will make an impact of CO2 emissions. With high upfront costs and lack of incentive programs, it will be difficult to convince most landlords to invest in solar energy.

Education and Information

Under this model, the Greener Housing Coalition would focus on the goal of education. Various specific strategies to do so that we have brainstormed are “Energy Saver” campaigns, workshops and webinars, art and media installations, newsletters, social media campaigns, and Instagram features.

Per conversations we have had with experts working in sustainability initiatives (see define report), there is also an opportunity to raise awareness and affect behavior change before first years move off-Grounds. This would likely take the form of webinars, newsletters, or op-eds in the Cavalier Daily, which publicizes student pieces to the entire University community.

Analysis from 12 randomized controlled trials found that webinars “are more effective than asynchronous learning management systems” and more effective than face-to-face classroom instruction (Gegenfurtner and Ebner, 2019). This was in higher education as well as professional training.

Research on newsletters found that they are effective when targeted to a motivated audience, supporting and enforcing education messages within a larger effort. Finally, results from surveys demonstrate that people tend to scan newsletters, therefore the most effective newsletters would offer intriguing information and present action steps clearly (Broussard and Floress).

While these would likely lead to high levels of education, the primary challenge with education and information is translating it to action. If we spend all our effort producing educational materials and info-sessions that are not seen by many people, or do not lead to concrete action, we will not make a substantive impact on emissions. As we have heard from

various experts, the face-to-face connection is often essential in getting people to register for energy audits and take other actions.

It is also important to note that in this model, we would either be a stand-alone organization, or we could provide information to already-established organizations. The latter ought to be considered in order to avoid doing duplicative work. There are various possible locations for our information - notably, through UVA's website on off-Grounds housing and through the UVA Office for Sustainability.

UVA offers information on student housing in two places. Their off-Grounds housing website, which is more related to our project, would be a perfect house for our information. Among others, they have links to information on "How to Make Smart Housing Decisions Brochure," "Off-Grounds Housing Guide," "Off-Grounds Housing Talks - Tips for Living Off Grounds," and "Suggested Questions for Landlords" ("Resources"). They have no information on sustainability. Second, UVA's office of Housing and Residence Life (HRL) offers information online. However, UVA has an incentive to encourage students to live on-Grounds, and as such, does not provide adequate resources for off-Grounds housing. For example, the "Housing and Residence Life" webpage has the Off-Grounds Housing Fair listed as an event but has no information on said page ("Off-Grounds Housing Fair").

One example of a larger organization that has expressed interest in our educational mission is the Office for Sustainability. They operate in the education, and events, space. They attract sustainability-minded students who may already be knowledgeable about reducing emissions. However, from our conversations with OFS and sustainability leaders at UVA, it is clear there remains an information gap for off-Grounds housing emissions.

Overall, while we hope to reach more students than just those that are already interested in sustainability, a strategy that focuses on information may only shift behavior for students that feel a vested interest.

Non Profit Association

For the integrative organization, we struggled at first to find the right format to fit our needs. To start, we examined the business model of insurance companies. This nature of "pooling risk from individual payers and redistributing it across a larger portfolio" (Ross) is similar to the process we envisioned. However, we found a better model for our organization.

According to the Internal Revenue Service, an association is "a group of persons banded together for a specific purpose" (IRS). For our integrative organization, that "group of persons" would be students/renters and landlords in the Charlottesville area, and the "specific purpose" would be to reduce their utility bills and energy consumption.

And so we are looking into transforming the Greener Housing Coalition into a nonprofit association. This model affords us many opportunities, including the potential to file for tax-exempt status with the internal revenue service (Imani). Furthermore, we can follow the well-defined format of nonprofit organizations (Imani):
A true non-profit organization relies solely on donations to operate, but we could potentially create a format that relies on membership dues and revenue from events as well (this will require additional research and consultation with industry experts)

As can be seen, this idea has the potential to create vital infrastructure. That being said, it is important that we're clear on the difference between a non-profit organization and association (Schindlinger):

Non-Profit	**Association**
Mission-focused	Membership-focused
Tax-exempt due to mission-focused nature	Mostly professional organizations that are not tax exempt
one executive director with a sole focus	Could have a director that oversees multiple organizations
Small to large staff sizes	Tendency is for small staff sizes
Board members and officers elected by the board	Board members and officers elected by members
Potential for positions that are not well-defined	Well-defined board and officer roles
Bylaws and policies can be easily amended by the board	Bylaws and policies may require membership approval for amendments

As it happens, the Greener Housing Coalition could be adapted to fit either of these formats. While our organization will undoubtedly be mission-focused, this does not prevent us from qualifying as an association. Although associations are membership-focused, the most concrete way to attract members is with a clear-cut mission (Rominiecki).

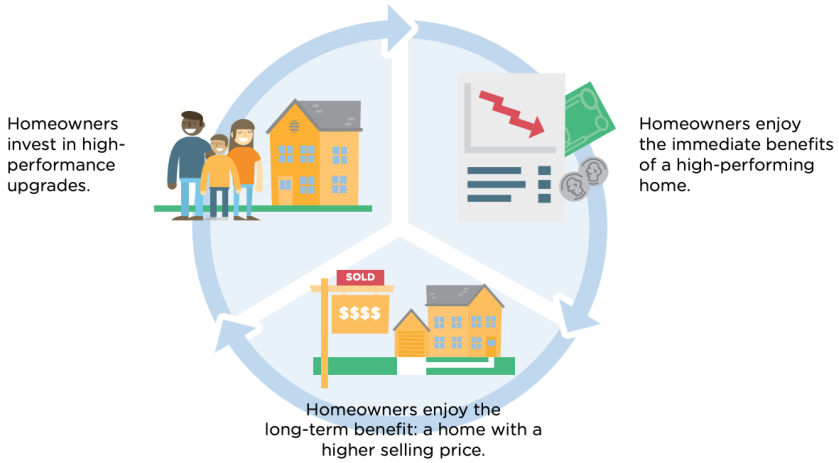
There are plenty of examples of non-profit organizations that deal with housing, including the Charlottesville Public Housing Association of Residents. This organization works with residents of the city's public housing complexes to improve living standards, monitor safety, and partner with residents to develop their careers (PHAR Cville).

The other intriguing factor of this design concept is the potential for integration with other ideas. Trade associations typically have a wide range of responsibilities, and almost always utilize some form of a website (Banister). The website for our association could integrate some form of the mapping software or renter reviews that were mentioned previously.

Certification System

Market transformation in the context of sustainability is change through collective action and programs that increase demand for energy-efficient and sustainable products, pushing companies and service providers to produce and offer more energy-efficient technologies and services (Brookstein and Caracino). The cycle of Market Transformation in the real estate market is depicted below.

The Cycle of Market Transformation



Source: Brookstein and Caracino

The Greener Housing Coalition has discussed in length how providing more energy efficient options for students to live in and making it clear where these options are could influence the student housing market. We believe that a higher demand from students for energy-efficient homes and the preference for homes with energy-efficient appliances would act as a big motivating factor for landlords to make and advertise how their properties fulfilled these goals. This is similar to the process of market transformation described above

in relation to high-performing homes. Similarly, our goal for the outcomes of market transformation are parallel to that above:

- To make energy-efficient features more visible to renters
- To make potential renters more excited about energy-efficient features of a home
- To increase understanding of how these features can save renters and landlords money while they pay rent and/or utilities

Some differences are, of course, that the long-term incentives do not apply to the student consumer as students are often only living in one place for a year at a time and as they are renting and not buying. They do not have to be concerned with the future property value. These incentives do, however, exist for the landlord who owns the property and may want to sell it in the future.

The certification solution concept would work to achieve the first desired outcome by creating a way for the energy efficiency in rental properties to be outwardly apparent. It would also generally raise awareness of the Greener Housing Coalition by demonstrating where it has had an impact and assisted homes in becoming more energy efficient. This would hopefully increase the understanding of the benefits this can have to renters and landlords through conversation between neighbors and curiosity about our organization in areas where certified homes are prevalent.

Pearl is an organization in Charlottesville that currently works to certify high-performance homes in order to make high-performance features apparent to consumers and raise awareness of how it increases the value of a home. To certify a home, Pearl administers the Home Performance with ENERGY STAR Program. It has certified over 31, 598 homes so far ("About Pearl"). Pearl also works to foster a network of homeowners, contractors, business owners, and real estate professionals to help people make the changes they need to make their homes more high-performing ("About Pearl").

Similar to Pearl's goal of making high-performance elements of a home visible with their certification, we want to make the energy-efficiency changes student households make with our help visible. We do not believe this would be redundant in Charlottesville, as we would be catering to students and renters, whereas Pearl's focus is on homeowners.

Using signs can be a very effective way to promote a brand or organization. This is in part due to the way it can foster brand loyalty ("3 Mail Benefits of Branding with Signage"). Having more signs in a certain place, increases your visibility in that community. This increases your recognizability, which in turn builds trust. It also portrays an image of consistent availability to your audience, making consumers more likely to try and use your services ("3 Mail Benefits of Branding with Signage").

Another common way signs on lawns are utilized are to promote political candidates. In this, signs are relatively effective. They do not increase voter turnout overall, however, there does seem to be a greater number of votes for particular candidate in areas where they have out up lawn signs compared to areas where they did not (Thayer). This implies signs have some effect on people who were planning on voting.

From the findings on the effectiveness of lawn signs for political candidates, we may predict that the signs or stickers will not directly translate to action by people who see them and are not already interested in saving energy. Additional efforts will be required to connect the people who now recognize our name to the resources we can provide and build interest in getting their own homes to be energy-efficient.

This relies on two concepts from behavioral science. Self-perception theory states that people determine their attitudes based on an assessment of their own behavior (Adams). The foot-in-the-door phenomenon is rooted in self-perception theory and states that as people agree to smaller asks, they begin to see themselves as the type of person who acts in a certain way, making them more likely to agree to larger asks later on (Adams). This was demonstrated in a study by Freedom and Fraser in 1966 in which after agreeing to put a smaller sign in their window encouraging people to “Keep California Beautiful,” they were then more likely to agree to put a larger sign to the same effect on their lawn (Adams). Getting people to agree to smaller tasks, like installing programmable thermostats, will make them more likely to agree to larger tasks later on, like installing a heat pump water heater. Similarly, people who display a sign showing they are certified by the Greener Housing Coalition will be more likely to have attitudes that support sustainable behaviors and will make more energy efficient changes in the future.

Decision Matrices

Evaluating each solution concept

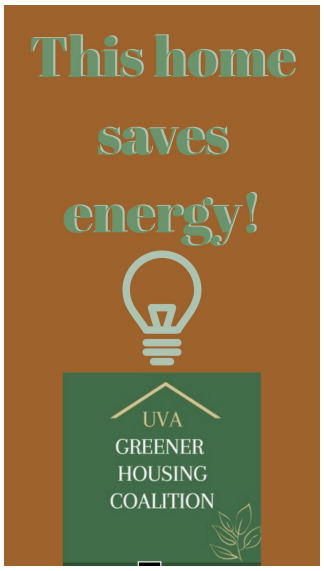
Each of our final six solution concepts were evaluated using a decision matrix that ranked them on the metrics established earlier. Tables demonstrating this process are included below, with a total score calculated.

Awareness & Events Model*:* The GHC will host events for students to connect with local partners, where we will facilitate a commitment for action. Some examples include a formal dinner with speakers or an energy challenge between student organizations.

Metric	Score	Rationale
Sustainability (impact on emissions)	4	By hosting events and focusing on partnerships, this model would be able to reach many students and depending on which
Affordability	2	While this would be a more expensive strategy, the buren of that cost would be on us, raising the financial support needed to host events, while students would be able to freely participate and attend.
Accessibility	5	Events will be easy for students to attend.
Practicality	4	This would require a dedicated team, as the most successful events at UVA are a focused effort of an organization that works all year leading up to them. In addition, given the amount of organizations at UVA, raising awareness requires lots of time.
Landlord support	3	There would be no reasons for landlords to oppose this, but this is unlikely to generate strong participation or support from landlords.
Outreach	4	Given that this is accessible and affordable, and the aim of events is to attract a large number of students, this is the strength of this solution.
Engagement	2	Events are unlikely to translate into high engagement, unless they are specifically tied to getting students to commit to work with organizations such as LEAP; even in such a circumstance, we would expect only 20% of students attending an event to commit.
Total Score	24	

Certification System: This solution concept includes a certification process for apartments and houses that have made energy efficiency changes to their utilities. To be certified a home must have done the following things:

- Install Programmable Thermostat *(around 10% reduction)*
- LEAP Audit
- All changes LEAP suggests *(dependent on energy habits)*



Certified homes would display a sticker or sign like the one to the right with the hope that an outward sign of energy-efficient changes would motivate people to get certified and demonstrate to their neighbors they care about the environment and benefit their landlord by advertising this to future renters. This would then have the added benefit of promoting the Greener Housing Coalition with its name on the sign or sticker that shows a home is certified.

Metric	Score	Rationale
Sustainability (impact on emissions)	3	The certification itself does not reduce any carbon emissions, however the tasks it requires for a home to be certified does. The installation of a programmable thermostat can reduce a home's carbon emissions by 10%. The changes made by LEAP after their audit reduce emissions by varying levels depending on what is determined is necessary in the audit. The various changes they could make, however, can reduce emissions significantly. (See David's external research page 25-31).
Affordability	5	This would not cost the student anything.
Accessibility	3	While actually displaying a sticker or sign takes relatively little effort, making the changes necessary to get certifications requires more time and effort on the part of the student. This is also dependent on the student's current behaviors in regard to saving energy and the changes that LEAP lays out after their audit.
Practicality	5	This solution concept is very feasible to implement, adding more more free step to students we are already working with.
Landlord support	4	We believe this would have high landlord support

		because it would make apparent that their properties were energy efficient, which would be an attractive element to potential renters and could increase its value.
Outreach	5	This solution concept makes the UVA Greener Housing Coalition more visible throughout the student and greater Charlottesville community, promoting our mission to any person who walked by any house or apartment with the sign/sticker and enhancing our brand recognition.
Engagement	2	The link between a student seeing a sticker or sign on someone's property and actually taking to make their own home more energy-efficient is weak as there is no direct connection between them and the resources the Greener Housing Coalition could provide them in this solution concept.
Total Score	**27**	

Education and Information Model: Our main goal will be to educate and inform students on how to reduce their residential emissions. From newsletters to webinars, we would focus on capturing the attention of first-years about to move off-Grounds and raise awareness of the resources available to them. The end goal would be for sustainable living resources to become common knowledge around Grounds and for all students to know they can come to the Greener Housing Coalition as a student-centered resource.

Metric	Score	Rationale
Sustainability (impact on emissions)	1	Educating people to be more energy efficient or to access resources in Charlottesville to reduce their household emissions only reduces emissions if it leads to significant behavior changes. Even so,
Affordability	1	This would be an extremely low-cost solution from newsletters to webinars, and would not cost students anything.
Accessibility	5	This would be freely accessible to all.
Practicality	4	
Landlord support	3	There would be no reasons for landlords to oppose this, but this is unlikely to generate strong participation or support from landlords.
Outreach	3	
Engagement	2	With the exception of sustainability-minded students, information and education is likely to not lead to sustained behavior change within houses. In addition, educating students as First-Years is counterproductive, as there are no actions they can take to live greener off-Grounds as First-Years, and we may lose their engagement when they move off-Grounds.
Total Score	19	

Foot in the Door: In this solution we aim to build a system that gradually asks greater tasks of a consumer in order to weatherize and create a more sustainable home. For example, the first task may be to reduce water usage. A more advanced task would be to install a programmable thermostat and a LEAP home energy audit. The mission will be to get people more in tune with their homes and aware of the energy they are using.

Metric	Score	Rationale
Sustainability (impact on emissions)	5(tasks 1-7)	There is a significant amount of potential CO2 reduction. Within the tasks assigned in the program there are several technologies developed for the purpose of CO2 reduction.
Affordability	1(Completion of all Tasks) 5 (tasks 1-4)	Overall if you are to complete all of the tasks it is a rather expensive endeavor. However for the purpose of students tasks 1-4 are incredibly attainable and cheap.
Accessibility	5(Tasks 1-4) 2(5-7)	Tasks 1-4 are accessible to all, homeowners or renters. In addition they present no financial barriers. Tasks 5-7 are recommended for homeowners but not limited to them. Additionally tasks 5-7 may present financial barriers.
Practicality	4 (Tasks 1-4) 1(Task 5-7)	Full completion of the program is challenging. However tasks 1-4 are very practical as they are mainly behavioral alterations or minor purchases.
Landlord support	4(Tasks 1-4) 1(tasks 5-7)	Tasks 1-4 require little to none confirmation from landlords in an apartment of home. However for tasks 5-7 renting may present issues. Homeownership is recommended when trying to achieve tasks 5-7.
Attractiveness / outreach	2	As there is no prize it is fair to say the incentive to complete the program is minimal. For a select few bragging rights and knowing you are doing good in the world is enough incentive. The goal is to minimize your CO2 emissions and an attractive return on investment.
Engagement generated	2	The program is mainly spread by word of mouth. This competition is a friendly competition among friends. Users can be as engaged or disengaged as they want.
TOTAL	27	

***Non-Profit Association*:** The Greener Housing Coalition would recruit students, renters, landlords, etc., to become part of our organization. We would gather their information and work with organizations like LEAP to implement changes on a larger scale. Examples would include bulk ordering of various technologies to reduce energy use, or week-long initiative for energy audits. The organizations we utilize could change on a case-by-case basis, as we expand to address other factors contributing to residential emissions.

Metric	Score	Rationale
Sustainability (impact on emissions)	4	The association will work with organizations like LEAP extensively to improve off-grounds housing and therefore reduce emissions
Affordability	3	The association may eventually require the payment of dues by its members, but it should also reduce its members utility costs
Accessibility	5	There would be very little effort involved in joining the association
Practicality	2	There would be a large amount of work involved in the institution of the association, including extensive work with community partners
Landlord support	4	Landlords should be willing to join an association that can save them money
Outreach	4	The primary goal of the association would be recruitment of members
Engagement	3	While the association will be easy to join, effort will be needed to ensure continued engagement by its members
Total Score	22	

Website: A central website would be accessible to students and community members to see where homes in Charlottesville are most sustainable. They would be able to read about people's experiences improving their houses and a review of how accessible, affordable, and successful their experience was with whichever specific action they took. The website could include features such as a quiz to match your living situation with a few resources.

Metric	**Score**	**Rationale**
Sustainability (impact on emissions)	3	A website can be very important in regards to providing the correct information in order to lead someone in the right direction. It does not directly impact emissions, only if students take action with our information provided.
Affordability	5	Having a website is very affordable, it will be free of charge for students to access. As for website costs it will be around 10-12$ a month to maintain.
Accessibility	4	This will be accessible to all with a working internet connection, and will be very easy to navigate.
Practicality	3	Having another free valuable resource will be very beneficial for students, with it being online as well means it can be accessed from anywhere on any device.
Landlord support	2	The landlords shouldn't be opposed to this idea as it is information that can benefit both parties. Though, this does not mean that landlords will be acting on the website.
Outreach	3	To have a database of all of the information in one place will be good for students to visit at any time. They don't need to meet at a specific time, they can browse at their own time. Establishing that reach through different marketing techniques will be key, as coming across as spam will not be ideal.
Engagement	5	A website will prove to be very engaging as it will provide to be a database with information, tips, and reviews for the viewer to see.
Total Score	20	

Comparing the solution concepts

Below is the matrix that combines all six concepts scored with our seven metrics:

Criteria	**Awareness Events Model**	**Certification System**	**Education and Information Model**	**Foot-in-the-door Strategy**	**Non-Profit Organization**	**Website**
Sustainability	4	3	1	5	4	3
Outreach	4	5	3	2	4	3
Affordability	2	5	1	5	5	5
Landlord Support	3	4	3	4	4	2
Accessibility	5	3	5	5	5	4
Practicality	4	5	4	4	2	3
Engagement	2	2	2	2	3	5
TOTAL	**24**	**27**	**19**	**27**	**27**	**25**

For the purposes of this matrix, all metrics were weighted equally. Based on these results, we can see the following **ranking** of our solution concepts (the first three are tied):

1. Certification System
2. Foot-in-the-door strategy
3. Non-Profit Organization
4. Website
5. Awareness Events Model
6. Education and Information Model

Sensitivity analysis

To further identify valid solution concepts, we performed a sensitivity analysis by adding weights to the different metrics.

1. Sustainability - Reducing the amount of carbon dioxide among students is the primary goal of our many solutions. It seems the majority of students come into college with poor energy usage habits. Reducing carbon per student is of the utmost importance.
2. Engagement - To make a real change it only takes a small portion of a population. We don't need everyone to make household changes, but we do need a select few to enact change.
3. Affordability - Since all of the possible solutions mentioned are targeting college students the amount of money coming out of the students pockets is pivotal. A solution that requires a large sum of money is not one designed for most college students and therefore is not effective.
4. Landlord support - The amount of students who live off grounds and are renters is exponentially higher than college home owners. Therefore the support of landlords is a necessity in most solutions mentioned.
5. Accessibility - Both time and effort are important for our solutions. How easy is it to attain the goal? Is the pay off worth the trouble of installment?
6. Practicality - College students do not have a lot of free time. Whether it be academics or athletics time is of the essence. Therefore, a solution needs to be time sensitive.
7. Outreach - The amount of students we can influence is very important. We don't underestimate the power of a few like minded individuals but in order to make a change on our campus we need to get as many people enlightened about the issue as possible.

Now, we can go back and create a new decision matrix. This time, we will consider three priorities of metrics, each one with a different score multiplier:

- High Priority (x3): Sustainability, Outreach
- Medium Priority (x2): Affordability, Landlord Support
- Low Priority (x1): Accessibility, Practicality, Engagement

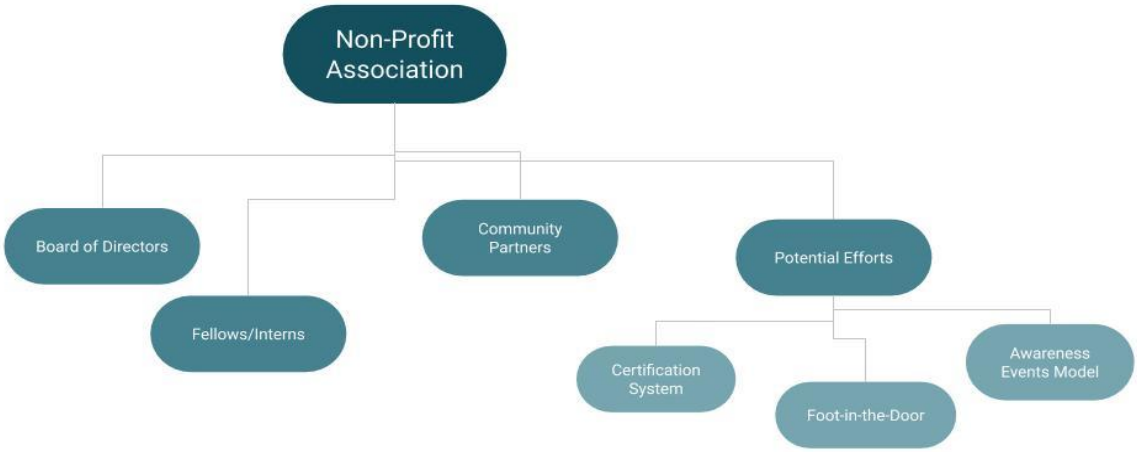
Below is the new decision matrix, showing the scores for each solution concept both with and without weight:

Criteria (weight)	**Awareness Events Model**	**Certification System**	**Education and Information Model**	**Foot-in-the-door Strategy**	**Non-Profit Organization**	**Website**
Sustainability (x3)	4	3	1	5	4	3
Outreach (x3)	4	5	3	2	4	3
Affordability (x2)	2	5	1	5	5	5
Landlord Support (x2)	3	4	3	4	4	2
Accessibility (x1)	5	3	5	5	5	4
Practicality (x1)	4	5	4	4	2	3
Engagement (x1)	2	2	2	2	3	5
TOTAL	**24**	**27**	**19**	**27**	**27**	**25**
TOTAL w/ weight	**45**	**52**	**31**	**50**	**52**	**44**

From this matrix, we can create a new ranking of our solution concepts. The rankings will be determined by total scores with weighting (the first two are tied):

1. Non-Profit Association
2. Certification System
3. Foot-in-the-door Strategy
4. Awareness and Events Model
5. Website
6. Education and Information Model

Illustration of Final Design Selected



Our proposed solution concept is centered around the creation of a non-profit association. At the start of this endeavor, we emphasized that our main goal was to create the necessary infrastructure to (1) cooperate with existing programs such as LEAP, (2) recruit student renters, landlords, and others to become a part of our effort, and (3) establish a system that can continue after our team is finished with the problem.

We firmly believe the format of a non-profit is exactly what we need to fulfill these goals. We define the components of our design as followers:

Members: As stated before, the "members" of our association would be renters and landlords with vested interest in reducing (1) their utility bills, and (2) the emissions of off-grounds housing.

Board of Directors: The board would be comprised of faculty members and students at UVA, members of organizations such as LEAP, and experts in association management.

Student Interns/Fellows: The board of directors would continuously hire students at UVA to facilitate the day-to-day operations of the association.

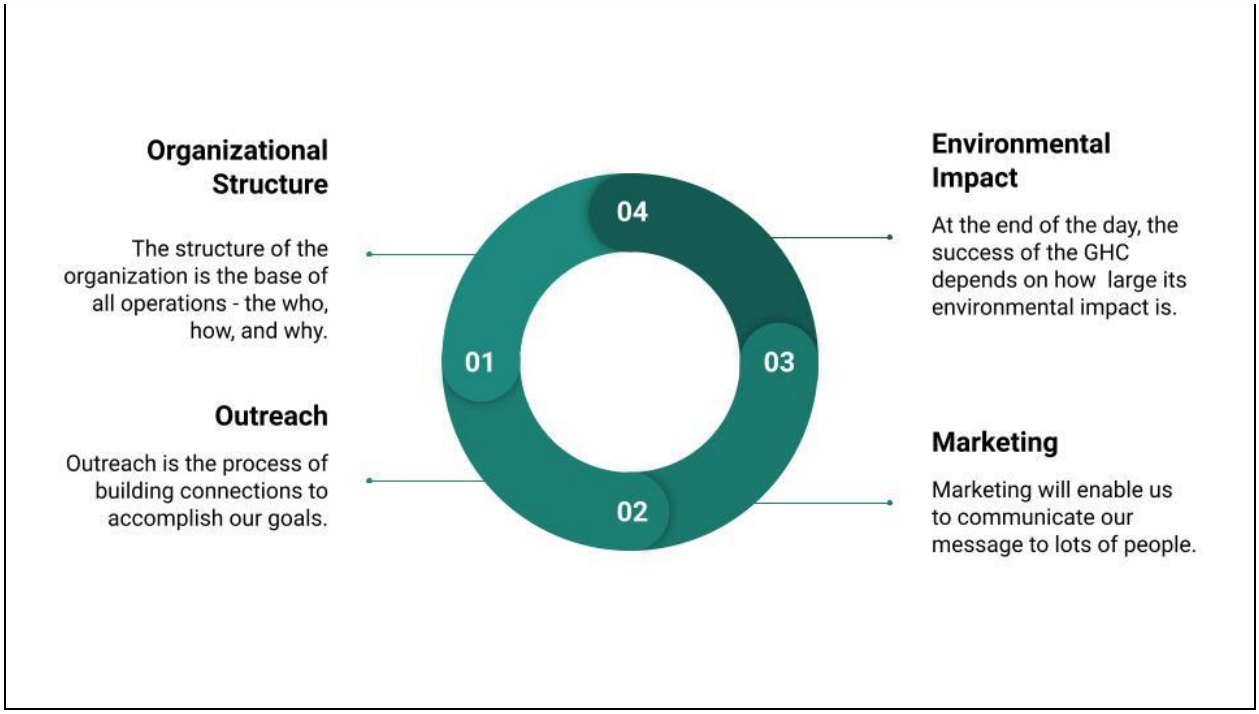
Community Partners: The association will work with organizations such as LEAP to organize energy audits and energy retrofits to the living spaces and/or properties of its members.

Potential Efforts. The association would work to develop a variety of programs that could aid in its efforts. The beginnings of these efforts would build off the research from this report, with the top 3 candidates for development being the certification system, foor-in-the-door strategy, and awareness and Events Model

Design Concept Exploration

Prototyping

Our initial prototyping plan is presented in this section. The process involved four distinct categories - organizational structure, outreach, marketing, and environmental impact. While these are distinct, they work together to create the overall experimental procedure that will be explored in the next section.



The Analytical Framework Behind the Prototypes

The organizational structure is the first prototype, because the form of the organization will be the base which informs the rest. Next will be outreach, which involves building relationships to fill the roles within the Coalition. Third is marketing, where we can communicate, recruit, and network on a larger scale. Finally, we will discuss how we can measure our overall environmental impact.

RMS and Prototyping:

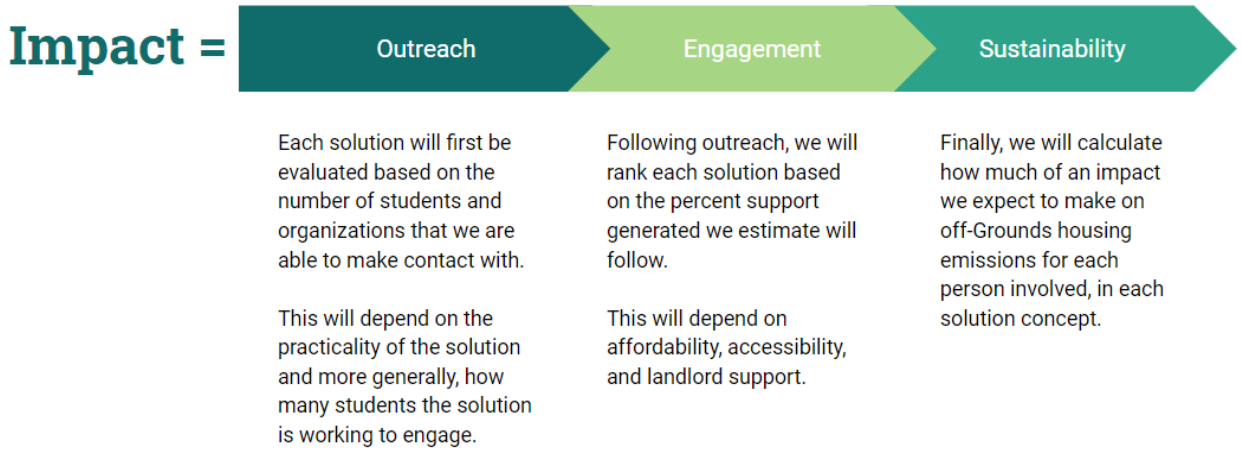
As we move ahead with prototyping our solution concepts, we want to reiterate the importance of utilizing our critical RMS combos to evaluate the effectiveness of our various prototypes toward our ultimate goal of carbon neutrality by 2030 for off-Grounds housing. As can be seen on pages 14-15 of our report, these metrics emphasize the importance of a multifaceted solution to create impact within our community. By utilizing these various metrics to measure our impact through outreach, engagement, and sustainability, we are able to evaluate the effectiveness of our prototypes going forward. Our evaluations will focus on the three main metrics of **outreach, engagement, and sustainability**.

Table 5: Metrics and Preliminary Specifications

Metric	**Quantitative Measurement**	**Acceptable Value**	**Ideal Value**
Practicality	Time and effort required to make the solution effective	3 hours total	1 hour total
Outreach	***Number of students***	1000	17,000 (all off-Grounds)
Affordability	Potential financial savings by students and landlords	25%	30%
Accessibility	Ease of use/access to the solution (ranked 1 to 5, 5 being the most accessible solution possible)	3	5
Landlord support	Percent of landlords involved who are supportive	75%	100%
Engagement or Uptake	***Average expected level of engagement*** Function of affordability, accessibility, and landlord support	100	1000
Sustainability	***Average emission reductions per person***	50%	100% (this would involve extensive work with the electric grid to accelerate the adoption of renewable

			energy)
Impact	= outreach * engagement * reductions = total reduction of off-grounds housing footprint	30%	100%

Overall, we will be measuring the success of our solution by the extent to which it is **impactful**. We will determine this by its ability to accomplish outreach, engagement, and sustainability. We believe this is important because a solution concept needs to do all three to be successful. For example, solutions can very effectively reduce carbon emissions, however, if it does not reach very many students it still is not effective. We will calculate this using the following equation.



Impact = *Number of students* * *Average expected level of engagement* * *Average emission reductions per person*

Organizational Prototyping

The Coalition

A large component of our prototyping during this process includes prototyping the actual structure of the Greener Housing Coalition. As it stands, we believe the goals of the Greener Housing Coalition will best be executed under the formation of a nonprofit organization. As we begin to form our organization and recruit community members to join our team, it is important for us to develop an understanding of longevity. Here, we outline our prototype for our nonprofit organization, as well as compare the nonprofit style of execution to other forms of organizations including UVA CIO's and associations.

RMS Combos for Organizational Prototyping

As we prototype a nonprofit organization, it is important to follow and outline the RMS metrics as stated before in order to evaluate the effectiveness of the organization towards our ultimate goal of carbon neutrality by 2030. Since we have multiple prototypes, we can break down these combos into a more simplified metric based on how this prototype contributes to **outreach, engagement, and sustainability**.

Target	Metric	Initial Ranking	Explanation
★ Effectivity in establishing outreach with students and organizations	Likelihood on a scale of 1-5; 1- uneffective 5- very effective	4	We rank this at a 4 because we believe that this type of organization will allow us to have fluidity in conducting outreach to both the student body and other organizations. While there may be a slight disconnect from UVA due to creating a separate
★ Effectivity in engaging with students and organizations	Ranked on a scale of 1-5; 1- uneffective 5- very effective	5	We rank this at a 5 because we believe that utilizing a nonprofit format will be the most effective in maintaining an involved group of members from both the student body of UVA and the greater Charlottesville community.
★ Effectivity in creating sustainable changes	Ranked on a scale of 1-5; 1- uneffective 5- very effective	5	We rank this at a 5 because we believe that using a non-profit format will give us flexibility to connect with more outside organizations that can assist and guide us towards more sustainable off-Grounds housing at UVA

These rankings will continue to be assessed as we move forward with our prototyping.

Non-Profit Organization

While nonprofit organizations fall under a variety of different categories in the United States, they all share the same common characteristics of being tax-exempt and mission-driven. At a cost of only $75 to file for articles of incorporation in Virginia, it would be of little monetary cost for us to create and form the Greener Housing Coalition.

Due to our need to connect community members with UVA faculty and students, we believe that a nonprofit organization has the best mold for what we want to accomplish. Our mission of promoting sustainability efforts in the community to reach students to make off-Grounds housing greener will be best executed through a mission-based organization ingrained in the community rather than solely through the university.

Steps for starting a nonprofit organization

- Here I will outline the different steps we will take to file the Greener Housing Coalition as a nonprofit in Virginia, and explain what we have done thus far to achieve these goals.

Step 1: Name Organization

We have done well to satisfy this step, as we already have decided on the name "The Greener Housing Coalition" (How to Start a Nonprofit in Virginia). Additionally, this name has not been taken by any other nonprofit organization in Virginia, so it is available for use.

Step 2: Recruit Incorporators and Initial Directors

With this step, this is where community and student outreach play a large role. Incorporators are those who actually sign the documents to create the nonprofit legally in the state of Virginia. These would essentially be the founders. In this case, the incorporators would be all or any of us, as Virginia only requires there to be one incorporator to file the articles of incorporation. The directors would be the stakeholders in the community that we recruit that have a devout interest and stake in our mission for the community. By definition, directors "make up the governing body of [a] nonprofit corporation and are stakeholders in your organization's purpose and success" (How to Start a Nonprofit in Virginia). One of the main goals of our prototype is to recruit members of the community who would want to serve on the Board of Directors. So far, we have done a great job at connecting with and identifying community and university members who would have a devout interest in our mission of sustainable off-Grounds housing. For example, we have been in contact with Erin Morgan, Marketing and Outreach Manager of LEAP, and she has expressed a devout interest in being on our Board of Directors. Additionally, we have been in contact with officers from the Office of Sustainability, as well as UVA Professors who all would be more than willing to serve on the Board of Directors. This is an important step in the prototyping of the nonprofit organization, and I will go into more depth later on about how exactly we want to structure the Greener Housing Coalition.

Step 3: Appoint a Registered Agent

While this step may seem a bit fancy in essence, all it really means is that somebody must be appointed to serve as the person to receive legal notices and receive phone calls during our operating hours of work (How to Start a Nonprofit in Virginia). While our prototype for this semester is mainly focused on structuring our nonprofit and finding ways to effectively connect community partners with students, this will certainly be an important step in the future when we move forward with establishing our nonprofit in the state of Virginia.

Step 4: Prepare and File Articles of Incorporation

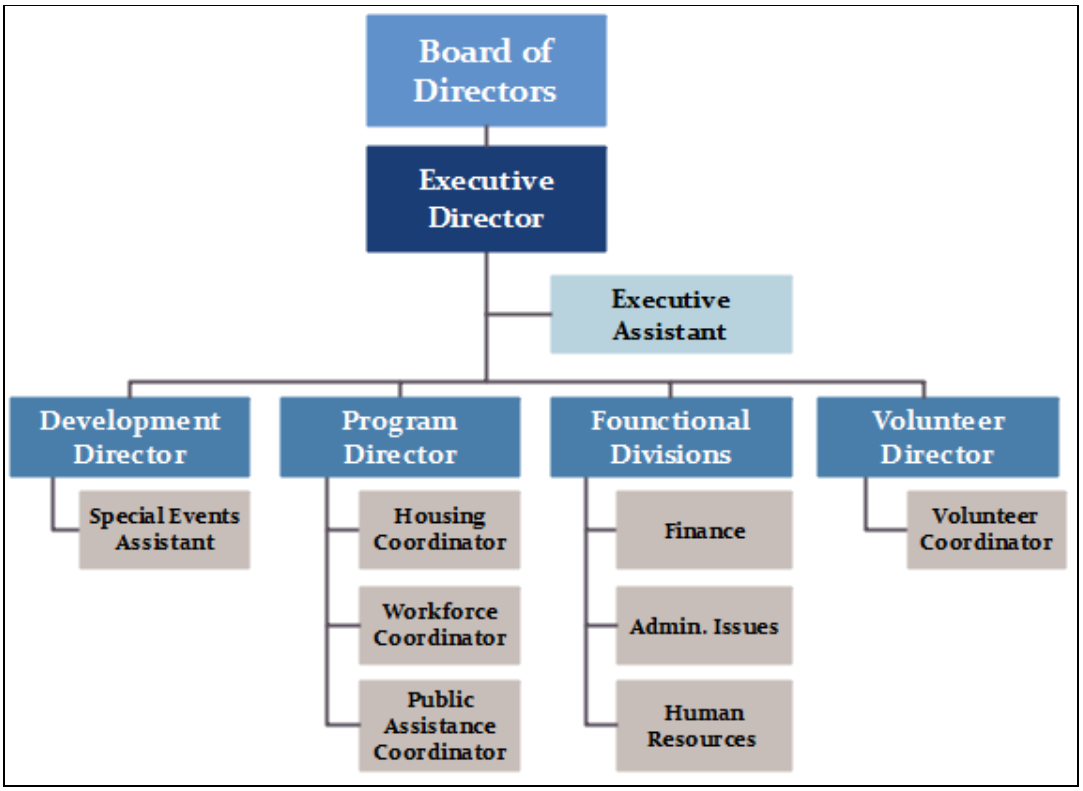
This step in the process essentially allows for a nonprofit to be verified and approved by the state of Virginia. At a cost of $75, this would help to certify The Greener Housing Coalition as an official nonprofit organization (How to Start a Nonprofit in Virginia). While our current prototype of our organization is not yet at the point to file these articles of incorporation, once we establish a board of directors and can prove our outreach can make a meaningful impact in creating greener off-Grounds housing, then we can move forward with the filing of these articles.

Step 5: Logistical Components

After filing for articles of incorporation, there are several other logistical components that we would need to complete to officially become a legal nonprofit organization. Some of these include obtaining an Employer Identification number to be identified by the IRS, creating a central location for storing and saving legal documents, and creating internal governing policies for the organization (How to Start a Nonprofit in Virginia). Once again, while all of these steps are long past the goals of the prototype stage, it is important to understand the full process of becoming a nonprofit organization and how we can work towards stability and longevity of the Greener Housing Coalition through this process.

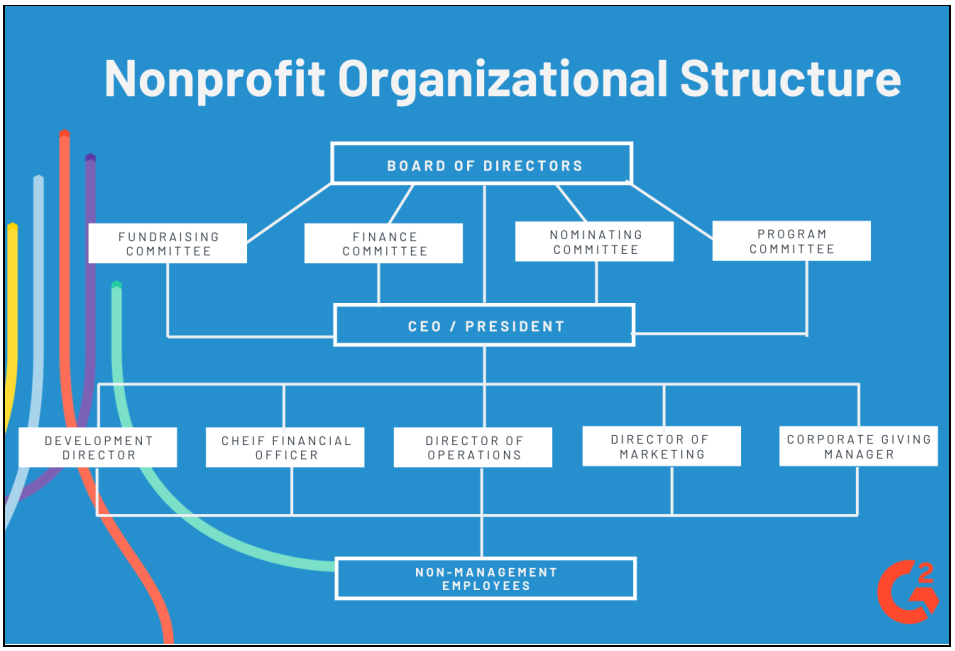
Prototype Organization Structure

With the progress of the Greener Housing Coalition thus far, we hope to be able to prototype the general power structure of our organization. There are many different structures of non-profit organizations, as they are used to serve a multitude of different purposes. However, we will seek to structure our nonprofit in a way that promotes community involvement, student collaboration, and stakeholder engagement. Below I have outlined a few traditional structures of non-profit organizations and how ours will be similar and/or different than the ones shown.



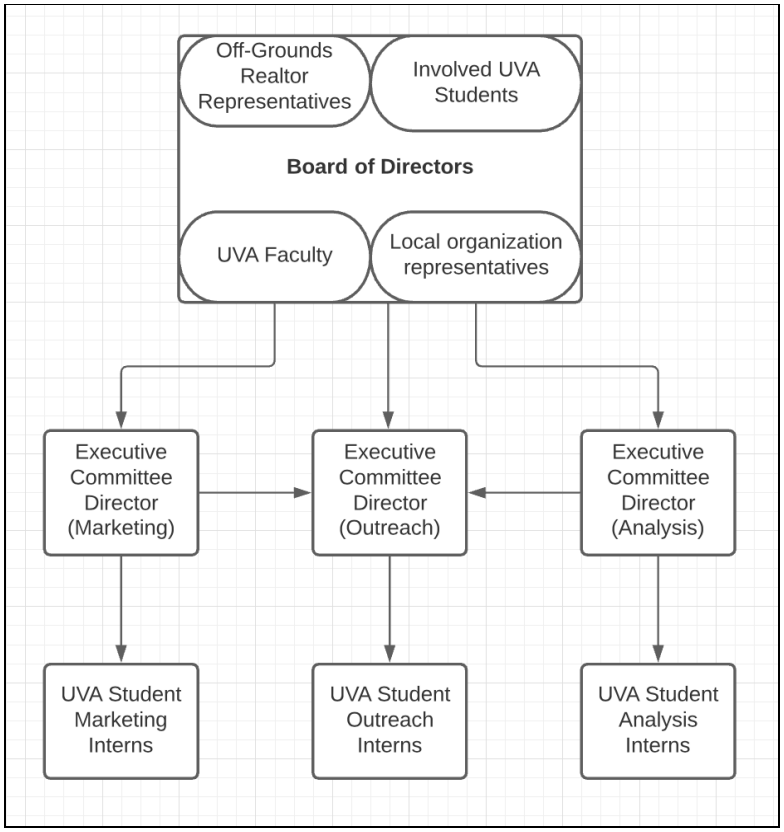
Example 1 of Organization Structure, Source:
https://www.orgcharting.com/nonprofit-org-chart/

In this example, the structure of the nonprofit is centralized around a wide variety of roles with many different levels of seniority. I believe that our nonprofit will do well with being matched with a Board of Directors at the top who works above an executive director. In our case, we could have multiple student executive directors who report to the faculty and community members on the Board of Directors, but also oversee student roles and committees underneath. What I think will be different for our organization is the number of committees and roles within the organization. To start, I think it will be more realistic to keep a more streamlined structure and limit the number of committees formed within the Greener Housing Coalition.



Example 2 of Organization Structure, Source: https://learn.g2.com/how-to-start-a-nonprofit

This structure of a nonprofit organization is very similar to Example 1, but flip-flops the power structure of committees and a president/executive director. From this example, I think it is important to take away the importance of having “non-management employees” working to help execute the mission of the non-profit as a whole. For the Greener Housing Coalition, the non-management employees would be comparable to student interns that we could hire to help promote and execute green housing changes throughout the off-Grounds housing sector. While the initial prototype of our nonprofit will be centralized around a group of executive directors reporting to the board of directors from the community, I do think this diagram will be useful if we find that changes need to be made to improve the efficiency of our organization.



Our Prototype Nonprofit Organization

This prototype shows exactly how we plan on organizing the Greener Housing Coalition. Starting at the top, we clearly want to create a Board of Directors composed of various different stakeholders. We believe that this will be key in ensuring the longevity and effectiveness of improving the sustainability of off-Grounds housing at UVA. In terms of students we envision including students with seniority on the Board of Directors who hold special interests in sustainability and/or off-Grounds housing. Local organization representatives will encompass the sector of members of other nonprofits and companies like LEAP and C3 who are actively looking for ways to improve sustainability in Charlottesville. UVA faculty will include representatives like Professor James Groves, who has ample experience in educating students and, more importantly, sustainable development. We also would like to include representatives of real-estate groups in Charlottesville, who are interested in making sustainable improvements to apartments and houses. This board of directors will act as a board of educated individuals who can sponsor and support the Greener Housing Coalition as a whole. They will not be tasked with providing financial support, but will rather be viewed as a group of leaders who can share their opinions on decisions being made and provide insight into how the Greener Housing Coalition can achieve its ultimate goal.

Making our way down the diagram, we can see how the structure of the nonprofit moves to a group of executive directors who will oversee their rightful committees. As of now, the important committees to focus on in achieving our efforts will be the marketing committee, the outreach committee, and the analysis committee. The marketing committee will focus on creating social media to promote the efforts of GHC. The outreach committee will help to connect with local organizations and students to make home improvements and take sustainable action. The analysis committee will focus on quantifying our data and creating graphs and models to show the sustainable improvements made by the Greener Housing Coalition. While this is only a prototype, we feel that this way of structuring our organization will be optimal for a streamlined path of success in improving sustainable housing.

Nonprofits vs. the field

The two main organization structures which we have compared the non-profit style to are associations and UVA CIOs. Here I will outline the structures of both associations and CIOs and specify why we have chosen the non-profit style over the rest.

Associations are very similar to nonprofit organizations. Both are tax-exempt organizations and both are focused on improving some sort of aspect of society rather than gaining profit. These two mainly differ, however when it comes to the type of people served. Nonprofits are mission-focused and do whatever means necessary to work for the common good of the mission. On the other hand, associations tend to cater to members of the organization and provide services and products to members of that given organization (Price 2018). This distinction is important to us because we want to emphasize our mission for the greater good of the Charlottesville community rather than solely hone in on serving our members. We want to focus on our mission rather than membership.

UVA CIOs are another option we considered in the formation of the Greener Housing Coalition. “CIO” stands for Contracted Independent Organization. These CIOs act as a way for UVA students to join or create their own organization. While CIOs are formed through a “coalition” of dedicated UVA students, they are not technically covered under UVA’s risk management plan, allowing them to operate independently. There are many benefits to creating a CIO. For example, there is ample opportunity for funding for CIO activities. Additionally, CIOs can gain access to many university resources that would not otherwise be available (i.e. private workspace). While we highly considered using the CIO structure, there were many aspects of CIOs that deterred us from it. To start, at least 51% of members must be UVA students. While we do not foresee an issue gaining this sort of following, we want to provide emphasis on community involvement rather than just student engagement (UVA Student Engagement). Additionally, due to UVA’s commitment to expanding on-Grounds housing, we foresee we might have trouble gaining support and funding through the university itself, as they may be reluctant to assist in a competing branch of student housing. Lastly, while we are only in the prototype stage of the model, we would like to create an

organization that can be applicable to other universities around the country. Creating a CIO would restrict the structure of GHC to the guidelines of UVA. A nonprofit is a much more adaptable and applicable structure in anticipation of future expansion to other university communities.

Funding

Another large component in the formation of our nonprofit is access to funding. While the prototype stage of our organization will not require much financial support, future expansion and additional endeavors may require access to funds. Here I will outline some of our options for funding for the nonprofit.

1. UVA Grants

There are many different funding opportunities available through the university. Grants are often a great, but not guaranteed, option for receiving necessary funding for our project. Specifically for sustainability-driven projects, UVA offers The Green Initiative Funding Tomorrow Grant. Outlined on UVA's sustainability website, "*The Green Initiative Funding Tomorrow (GIFT) Grant is a fund that enables and empowers students to take an active role in ensuring UVA's commitment to a sustainable future through the distribution of a $10,000 budget for sustainability initiatives*" (UVA GIFT Grant). This could be a viable option for us going forward, as it caters specifically to sustainability initiatives.

Additionally, UVA offers grants through the Equity and Environment Fund. As outlined on its website, "*The Equity and Environment Fund, supported by the Civic Engagement Subcommittee, is available for students/student groups for community-based initiatives or projects that sit at the intersection of equity, justice, and sustainability*" (Grants and Funding UVA). This could also be another great option through the university, as it directly funds community-based initiatives.

The prospect of receiving a UVA grant is definitely one to consider as we move forward with the development of the Greener Housing Coalition. While they are not guaranteed, evidence of meaningful work and effective change will hopefully push our application through to receiving the grant.

2. State and Local Foundation Grants

As a more general approach, we may want to consider applying for grants offered by various foundations in Virginia. While these are probably more difficult to obtain the university grants, it may be something to consider if we want to take a more generalized approach to our nonprofit. There are many foundations that support local initiatives here in Virginia. For example, the J&E Berkeley Foundation supports organizations that work to improve the quality of life of people living in the Charlottesville area (Virginia Grants and Foundations).

This could be something to look into, as we will have a strong connection with the Charlottesville community.

3. Donations

While we may want to sway away from searching for and accepting donations, this may be something to look into if we are in need of quick funding and financial support. We do not intend for our Board of Directors to be comprised of donors. However, this could always be an option if we plan on restructuring our initial plan.

Metrics

In this current stage, we can conceptualize our thought process of wanting to start with a non-profit organization through the use of the following metrics. We developed rankings for several different components of establishing a non-profit versus other types of organizations. See here.

Non-Profit

Target	Metric	Ranking	Explanation
★ Obtaining Financial Support	Likelihood on a scale of 1-5; 1- very unlikely 5- extremely likely	4	We rank this at a 4 because we believe that with assistance from free audits through LEAP, this will essentially cover most of our audit costs. Any additional funding we plan on obtaining through small grants.
★ Difficulty in Establishment	Ranked on a scale of 1-5; 1- not difficult 5- very difficult	4	We rank this at a 4 because we realize that establishing a non-profit will certainly take more time than other types of organizations. However, we believe that this will be the best way to achieve longevity and reliability for the coalition.
★ Room for Growth	Ranked on a scale of 1-5; 1- very limited 5- ample opportunity for expansion	5	We rank this at a 5. What we like most about the non-profit structure is the opportunity we have to continue expanding the coalition to higher levels. As we connect with more community members, we hope to use this structure as a strong platform for growth.

★ Engagement with the Community	Ranked on a scale of 1-5; 1- limited engagement 2- very engaged with the community	5	We rank this at a 5. Not only will we heavily rely upon support from groups like LEAP, but we also anticipate having many different members of the community work on our Board of Directors.

UVA CIO

Target	Metric	Ranking	Explanation
★ Obtaining Financial Support	Likelihood on a scale of 1-5; 1- very unlikely 5- extremely likely	4	By creating a CIO through UVA, we will not only have access to CIO funds provided through the university, but will still continue to utilize subsidized costs through LEAP and other community measures.
★ Difficulty in Establishment	Ranked on a scale of 1-5; 1- not difficult 5- very difficult	3	While it may take time, creating a CIO at UVA is fairly straightforward and does not require nearly as much work and time as a non-profit organization.
★ Room for Growth	Ranked on a scale of 1-5; 1- very limited 5- ample opportunity for expansion	2	We rank this at a 2. Unlike a non-profit organization, we are slightly limited to how far we can expand while under CIO status. While we can grow the coalition through UVA, if we ever want to grow beyond UVA, it will require different infrastructure.
★ Engagement with the Community	Ranked on a scale of 1-5; 1- limited engagement 2- very engaged with the community	4	We rank this at a 4. While we would still anticipate having a similar organizational structure, we would need much more student participation, which could mean less engagement with community members outside of UVA.

Outreach Prototyping - Annabelle

RMS Metrics of Outreach Prototyping

Target	Metric	Initial Ranking	Explanation
★ Effectivity in establishing outreach with students and organizations	Likelihood on a scale of 1-5; 1- uneffective 5- very effective	5	We rank this at a 5 because our outreach plan exemplifies the importance of creating connections with the community and utilizing a variety of tools and pathways to establish partnerships
★ Effectivity in engaging with students and organizations	Ranked on a scale of 1-5; 1- uneffective 5- very effective	5	We also rank this at a 5 because we believe that our prototyping efforts will not only help in reaching out to students and interested community members, but we anticipate that continued conversation will help create a lasting relationship to engage students and organizations with the GHC.
★ Effectivity in creating sustainable changes	Ranked on a scale of 1-5; 1- uneffective 5- very effective	3	We rank this a 3 because we believe that our outreach will start by specifically catering towards parties interested in creating sustainable changes in off-Grounds housing. The real challenge will be getting other people involved and helping to educate others in the importance of the GHC.

What is outreach?

There are many definitions of outreach. An report from the Institute of Work and Pensions defines the range of outreach possibilities from "those that draw on partnerships and networks with other service providers to deliver and promote (...) services in local communities" or "services (...) to raise the profile of services and inform potential customers of the provisions and help that is available to them." While both these definitions draw on the field of social work, I believe they lend themselves to a three-part definition of outreach for our project: outreach is defined as the process of

1. Creating partnerships to provide emissions-reducing services
2. Reaching out to students/renters to connect them to resources
3. Networking and developing potentially powerful allies

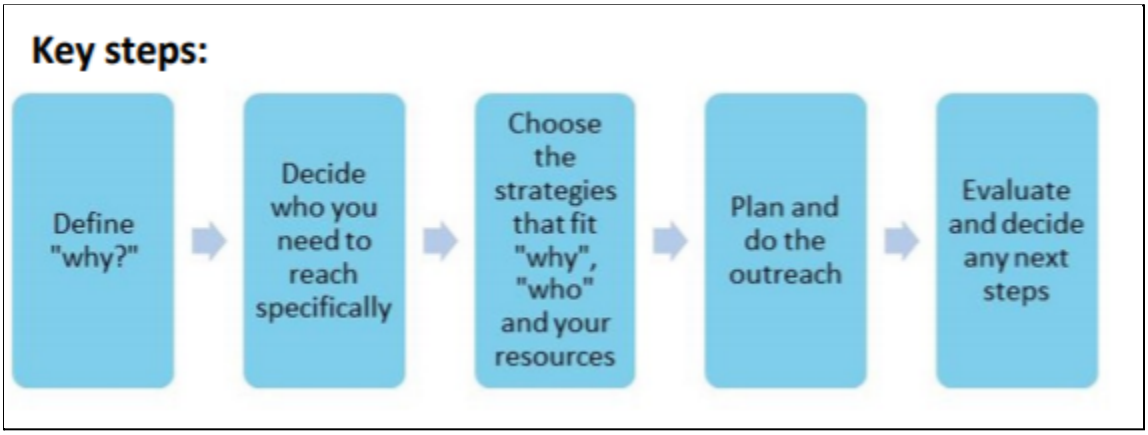
Outreach can be instrumental ("part of a strategy to achieve something else") or intrinsic ("the goal on its' own"), according to a Canadian community outreach guide. Common reasons for outreach are to consult or to engage. Both are relevant for the Greener Housing Coalition. Our outreach up to this point has focused on consulting with stakeholders, but our goal is quickly shifting to engagement - to get people to take certain actions. As written in Forbes, one can "leverage the community for knowledge" if focused on consulting. Their advice for engagement stands out: they advocate for letting "ambassadors lead the way" and targeting "the leaders on the ground." This is a strategy that I have inadvertently been using, by working with students who have become leaders on Grounds already. Finally, Forbes gives what the literature emphasizes as the key to outreach: "create mutually beneficial opportunities."

My research on community outreach has allumined two other trends: having multiple approaches to outreach based on who you are trying to reach, and using a one-pager as a primary communication tool.

First, many outreach organizations stress the importance of tailoring your approach to the specific donor, framing your pitch around the values of who you are pitching to. I believe the same extends to possible coalition partners - it is essential to emphasize that we have the same goals, rather than expecting them to work towards what the GHC wants.

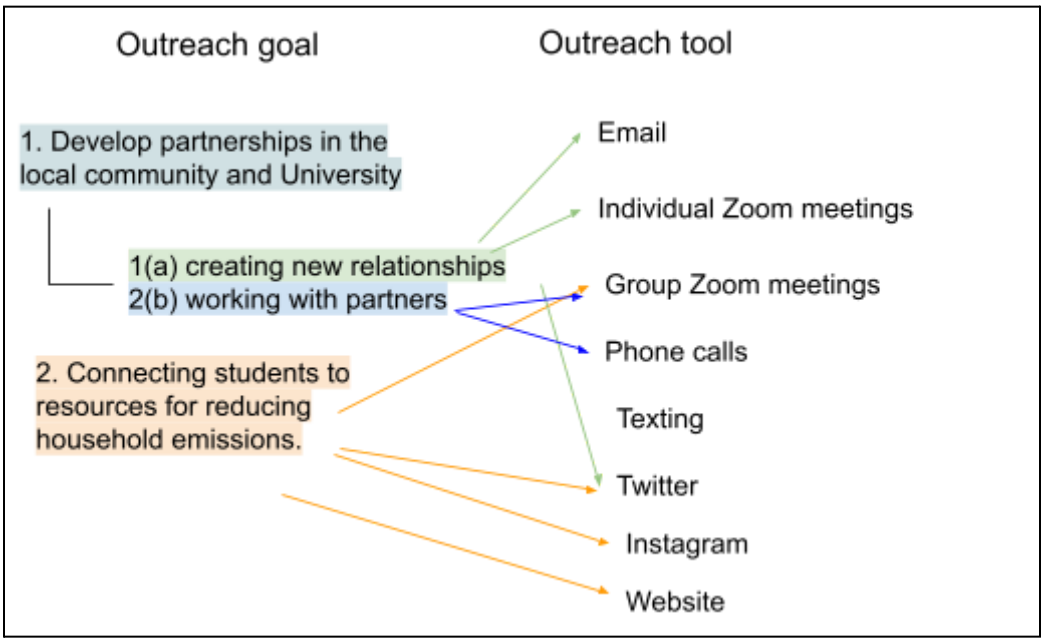
Second, the literature emphasizes the importance of creating a compelling one-pager, a consistent piece of outreach advice. Spitfire Strategies specifically recommend having an informative one-pager (focusing "on what you do and why it's important") as well as a persuasive one-pager (with a more targeted ask). Given that visuals are processed faster than text, this can draw in the attention of a potential donor or partner. One pagers do not typically look like one page of text (such a policy memo might), but employ colors and visuals to simplify the information and keep the reader's attention.

Planning outreach



Breakdown of Steps in Outreach, from [Community Outreach Lessons Learned and Good Practices]

I have used these key steps to create the diagram on the following page. This separates the Coalition's outreach goals (defining "why) to demonstrate which tools will be used to pursue outreach for those ends (choosing the strategies that fit). The latter two steps will be done once we put our prototype into place, and are discussed more below.



Tools for Outreach.

Note that the website can be either our own website, or (in the more near term future), hosting our information on someone else's website (UVA OFS and LEAP have already volunteered this).

Second, Zoom meetings have been intentionally split into "individual" and "group." Group meetings have been successful over the past year to keep all stakeholders on the same page and to brainstorm the next action steps that each person will do to further the entire project quickly. However, going forward, I plan to pursue more individual meetings for creating new relationships, as to not alienate any new additions to the project given that some partnerships are over a year old at this point.

Experts to reach out to for advice for each aspect of our project:

As I will be helping the others in the team by coordinating our outreach, part of my goals for the semester will be ensuring we are able to meet with experts to verify our findings and improve our processes.

Aspect of the project	Subject matter experts identified
★ Marketing and social media	We are still looking for experts.
★ Outreach	Professor Lehmann (has a nonprofit advocacy firm) Professor Shobe (Environmental Econ) Lela Gardner (OFS) State Climate Policy Network
★ Nonprofit association	James Cudahy Kodiak Hill-Davis (Annabelle's connection, nonprofit founder)
★ Environmental impact	C3 LEAP

Outreach lessons learned

Given that I (Annabelle) have been working on this project since April of 2020, I believe that the following lessons regarding outreach are salient going forward.

I believe a couple notable things have gone well. First, Zoom meetings have offered almost face-to-face communication that has enabled quick relationship development. Second, working with people who have broad networks has been invaluable - from students to employees at OFS, initial partnerships have led to multiple connections.

I hope to improve by developing some one-pagers, as this is stressed as a best practice for outreach. This will enable me to quickly reach out to people and provide them basic information about the GHC without scheduling a Zoom call in the future. In addition, I aim to have a 24-hour response time on email, quicker if possible. This will better respect the time of others and communicate my sincere commitment to this project. Finally, not having a social media presence has hindered our ability to keep people connected without reaching out by email, and drawing others in (although word of mouth has been working well). Therefore, I'm excited that we have extended our coalition to have a social media marketing prototype as well!

Marketing Prototype - Luca Pfeiffer

Marketing Research and How the GHC Can Implement Strategies

RMS Metrics of Marketing Prototype

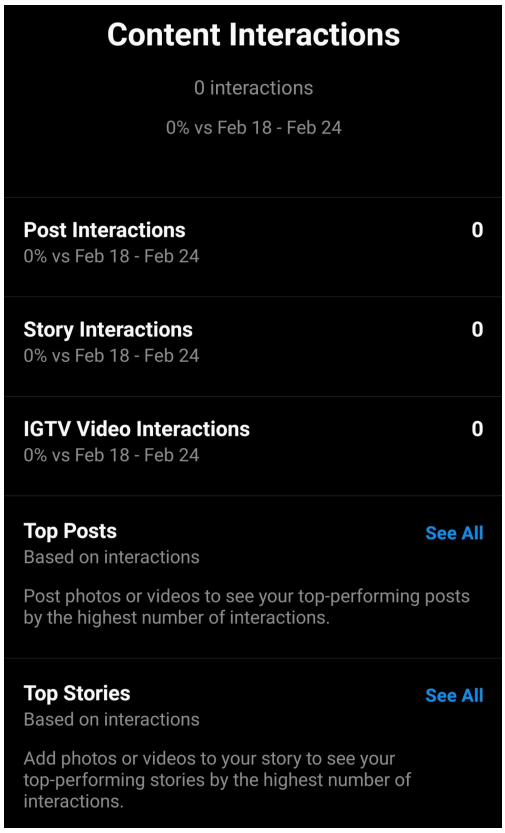
Target	Metric	Initial Ranking	Explanation
★ Effectivity in establishing outreach with students and organizations	Likelihood on a scale of 1-5; 1- uneffective 5- very effective	5	We rank this at a 5 because the various marketing tools outlined in the prototype will play a key role in reaching students and organizations on the importance of the GHC.
★ Effectivity in engaging with students and organizations	Ranked on a scale of 1-5; 1- uneffective 5- very effective	4	We rank this at a 4. We believe that the prototype marketing efforts will play a key role in recruiting and informing interested parties throughout the UVA and greater Charlottesville community. It This is not ranked as a 5, however, because many other factors will play into whether the interested parties actually engage with our organization.
★ Effectivity in creating sustainable changes	Ranked on a scale of 1-5; 1- uneffective 5- very effective	5	We rank this a 5 because the marketing prototype will be one of the ways we can communicate to the community the importance of our organization and outline ways they can get involved.

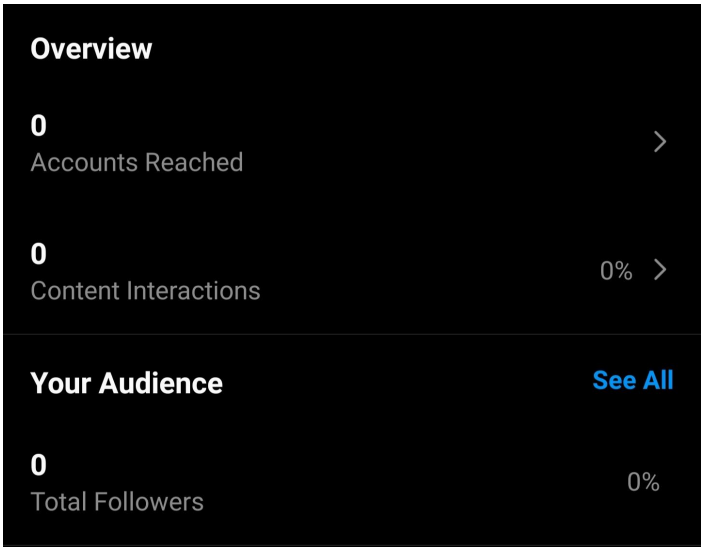
How to Create a Social Media Strategy in 8 Easy Steps

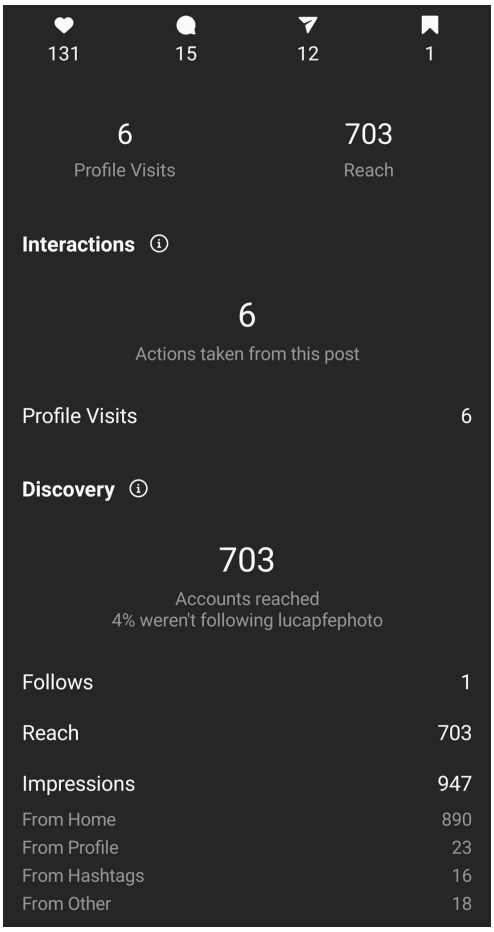
The first step in creating a social media marketing strategy is to set out SMART goals that are specific, measurable, attainable, relevant, and time-bound. Because of the setbacks the GHC faced, marketing efforts have not yet begun to take place, however, the goals set out in our interim report can be adapted for next Fall:

- 100 followers by the end of the fall 2021 semester
- 12+ feed posts
- 4+ story highlights
- 20 student energy audits conducted

In order to monitor our social media growth, we can use the Instagram analytics features available for business accounts to track our interactions and reach. This way we can continue to tailor our marketing efforts towards strategies that prove most effective.







Examples from my social media @lucapfephoto, which showcase the analytics present on a specific post

As the scope of the GHC's focus has changed, we have decided to place a greater emphasis on reaching UVA students. From a marketing perspective, this will allow us to promote our material through already established UVA CIOs and other organizations. Our material can focus on the needs of UVA students looking for off-grounds housing in Charlottesville, GHC members' personal experiences undergoing this same process will prove to be useful.

Building your social media marketing strategy for 2021

In addition to promoting our material through already established UVA organizations, the GHC can utilize Instagram's built-in marketing features as well as Google Adwords marketing campaigns. By using these services' audience targeting features, we can extend our reach to uninvolved students as well as non-student housing purchasers.

Having a consistent theme for our social media content will be important for our professional appearance and aesthetic consistency. The logo we created can serve as a color palettes template for future marketing material:

GHC Logo

Aside from being a part of our namesake, the green represents our end goal of making housing more seamlessly integrated with the natural environment. The blue sky continues with this theme as it showcases the natural beauty of an atmosphere free from unnecessary greenhouse gas emissions. The inclusion of the yellow light bulb over the green house showcases our focus on home energy use and the rising sun represents a new era of sustainable Charlottesville housing.

In order to not remain a faceless organization, GHC social media content will also include images of the GHC staff members as well as testimonials from students who conduct their own energy audits. This will allow our social media content to appear much more closely tied to the UVA community. In addition, we hope to remain an open organization for communication by promoting that our Instagram DMs and email is always open to any questions people may have.

The Ultimate Guide to Sustainable Marketing

As “Forbes reports millennials not only have money to spend, they care where they spend it: roughly 70% will pay more for brands that support a cause they care about,” our marketing material should keep in mind that many are willing to undergo additional inconvenience for a cause they care about. However, because we are now asking students to conduct energy audits themselves and are hoping to receive grant money to purchase and distribute items such as light bulbs, the cost towards students is no longer a large factor.

However, for more expansive auditing and energy saving technologies, we can attempt to get students to contact their property owners and ask them to make said changes. Property owners could be shown the potential long-term return on investments and could also feel economically pressured to do so if more students begin to request this from their housing. If the GHC is able to come up with some metric where properties are rated by some

sustainability index available to all potential renters, there will be increased pressure for property owners to act.

5 principles of sustainable marketing:

1) **Consumer-oriented**
   The GHC must always take in account how our marketing efforts are perceived by consumers. Because members have undergone their own energy audits, we know have the knowledge necessary to make this process as simple as possible for those conducting self-audits.
2) **Customer value**
   The cost of self-energy audits would be no more than ~20 minutes of one's time, and if the GHC successfully receives grant money, we will be able to provide students with technologies to reduce their home energy consumption free of charge.
3) **Innovative**
   By creating an easy-to-follow and entertaining instructional video for our self energy audit process, we will have created personalized media that helps students complete the process. By tracking our social media analytics, we will continue to innovate and improve our marketing strategy to better reach more people.
4) **Sense-of-mission**
   The mission of our organization is rather clear. We strive to make off-grounds housing in Charlottesville more sustainable by having students energy audit their homes and then provide them with the necessary appliances to reduce their home energy consumption. By tracking student's energy consumption data, we will be able to promote the tangible ways in which our organization has helped reduce Charlottesville's energy footprint.
5) **Societal**
   Our organization's end-goal clearly benefits Charlottesville and greater society by reducing our energy consumption. However, we can also focus on how this benefits each individual as they will be paying less for energy as a way to appeal to those who may not be as concerned by their environmental impact.

Similar Social Media Accounts + Takeaways

Before establishing our own social media platform, taking a look at how similar accounts operate will allow us to better utilize the tools and strategies available.

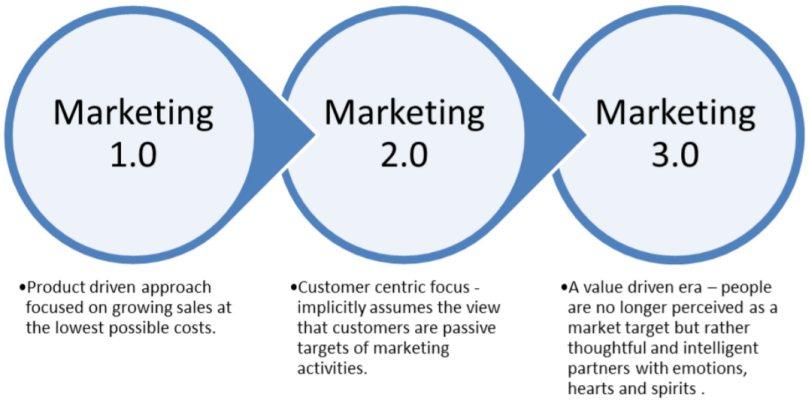
- https://www.instagram.com/leap_va/
  - Good blend of human-side and statistics/information
  - Posts do not follow a very consistent aesthetic theme, making the feed appear disorganized
  - Cluttered story highlights
- https://www.instagram.com/patagonia/

    - Very high-quality images, consistent aesthetics
    - Good use of short form video
    - Unnecessary story highlights
- https://www.instagram.com/wwf/
    - Excellent short form video that presents relevant information in a compelling manner
- https://www.instagram.com/toogoodtogo.usa/
    - Excellent feed organization - requires specific planning
    - Best use of story highlights + thumbnails
- https://www.instagram.com/greenamerica_/
    - Posts are attention-grabbing and informative
    - Lack of aesthetic consistency
- https://www.instagram.com/chesapeakebayfoundation/
    - Great blend of human-side + wildlife
    - Simple but effective use of story highlights
    - Aesthetic consistency
- https://www.instagram.com/take3forthesea/?utm_source=ig_embed
    - Good use of short-form video, IGTV, story highlights
    - Consistent color palette

The best accounts feature a variety of photo and short-form video content, remained aesthetically consistent, and utilized story highlights for purposes relevant to their brand. The GHC will seek to adopt these strategies and will do so by planning out content ahead of time to form a coherent aesthetic for our platform.

Guiding Academic Literature:

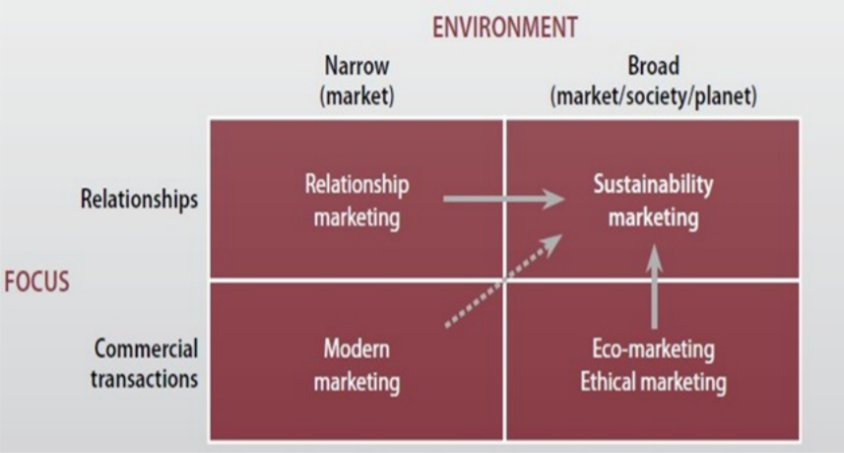
Sustainable Marketing -A New Era in the Responsible Marketing Development



In this paper, sustainable marketing is defined as “a business model that could meet the people’s needs, increase the efficiency of the development of global society, create new jobs and raise the level and quality of life for today and tomorrow.”

Although the GHC is not a business, our marketing efforts should still reflect our goal of increasing the efficiency of how our society manages its resources. Focusing on the needs of consumers today is obviously important, but we must also showcase how the changes we can make can carry on to future generations. Items like lightbulbs must be replaced in a somewhat frequent manner, however, other energy efficiency implementations such as more streamlined recycle practices and increased heating and cooling efficiency, can carry on to future property owners.

Sustainable marketing strategies: Creating business value by meeting consumer expectation



Source: Peattie and Belz (2010)

Figure 3. New Concept of Sustainable Marketing

With our current social media marketing strategy, the GHC will utilize a number of modern marketing techniques to grow our platform. The energy cost of using social media platforms is relatively low, but if the GHC decides to market using physical prototypes, we must be conscious of how we may decide to use resources.

Figure 2: Modern to Sustainable Marketing

By having a platform open to input and questions, as well as promoting energy audit testimonials and creating an instructional video to make the home energy audit process easier, we will ensure the GHC's marketing fosters meaningful relationships. In addition to the relationships with potential members, our marketing can place an emphasis on our relationship to the environment and how the GHC serves to make it more eco-friendly.

TRADITIONAL MARKETING MIX		SUSTAINABLE MARKETING MIX
Product	→	Customer solution
Price		Customer Price
Place		Convenience
Promotion		Communication

Source: Belz and Peattie (2009)

Figure 4. Traditional and Sustainable Marketing Mix

In comparison towards the traditional marketing mix, sustainable marketing contains different areas of focus the GHC must utilize. We are not promoting a product, instead we are giving customers a solution towards their inefficient energy consumption in the form of guided self energy audits. The price of our solution is the time they must spend conducting the audit as well as coordinating with the GHC when to pick up any beneficial appliances they may qualify for.

Figure 5. Proposed Sustainability Strategies for Fulfillment of Consumers' Expectation and Generating Business Value

The more convenient our solution is, the more participation we will get so we will make sure to make the Google Form and accompanying video as easy-to-follow and entertaining as possible. Communication and transparency about the GHC's plans and operations will be crucial towards making our organization approachable and effective.

Innovation	Product/ Process/ Marketing (with advanced technology)
Collaboration	NGO's/ Government/other organizations Environment protection campaigns
Communication	Constant communication with stakeholders and upholding transparency
Commitment	Constant engagement with consumers and employees

Table 1: Sustainable Marketing Strategies

Through our marketing efforts, we hope to convey our genuine commitment towards making the Charlottesville housing market as energy efficient and sustainable as possible,

and foster a community that feels open to reach out with any suggestions on how we could better our organization.

A framework for sustainable marketing

This paper lays out three different methods in which sustainable marketing can be achieved. The first of which is: **Green Marketing** – developing and marketing more sustainable products and services while introducing sustainability efforts at the core of the marketing and business process. This form of marketing closely aligns with the GHC's goals and will be implemented throughout our marketing efforts.

Social Marketing is defined as: using the power of upstream and downstream marketing interventions to encourage sustainable behaviour. This aspect of marketing will rely heavily on student testimonials and our social media presence. If people view their peers undergoing the energy audit process with positive feedback, they will be much more likely to follow suit.

Finally, **Critical Marketing** is defined as analysing marketing using a critical theory based approach to guide regulation and control and stimulate innovation in markets with a focus on sustainability, but moreover challenging some of the dominant institutions of the capitalist and marketing systems, to construct a more sustainable marketing discipline.

Box 2

Social Marketing:

1. Sets behavioural goals – Social Marketing Interventions should have a clear focus on behaviour, based on a strong behavioural analysis, with specific behavioural goals.
2. Uses consumer research & pre-testing – Developing a clear understanding of the audience, based on good consumer research combining data from a variety of sources helps develop a consumer oriented approach.
3. Makes judicious use of theory – Interventions benefit from being behavioural theory based and informed and should draw from an integrated theoretical framework.
4. Is insight driven – Focus should be on gaining a deeper understanding of what moves and what motivates the consumer. Identification of key factors and issues relevant to positively influencing behaviour allows actionable insights to be developed.
5. Applies the principles of segmentation & targeting – Avoiding blanket approaches to segmentation and targeting allows interventions to be tailored to specific audience segments.
6. Makes use of the marketing mix beyond communications – Interventions consider the best strategic application of the marketing mix consisting of the four Ps of 'product', 'price', 'place' and 'promotion'. Other Ps might include 'policy change' or 'people' for example delivering training to intervention delivery agents
7. Creates attractive motivational exchanges with the target group – Intervention considers what will motivate people to engage voluntarily with the intervention and offers them something beneficial in return. The offered benefit may be tangible (rewards or incentives for participation or making behavioural changes) or intangible (e.g. personal satisfaction, improved health and wellbeing).
8. Addresses the competition to the desired behaviour – Forces competing with the desired behaviour change are analysed and the intervention considers the appeal of competing behaviours. Strategies that seek to remove or minimise the competition are used.

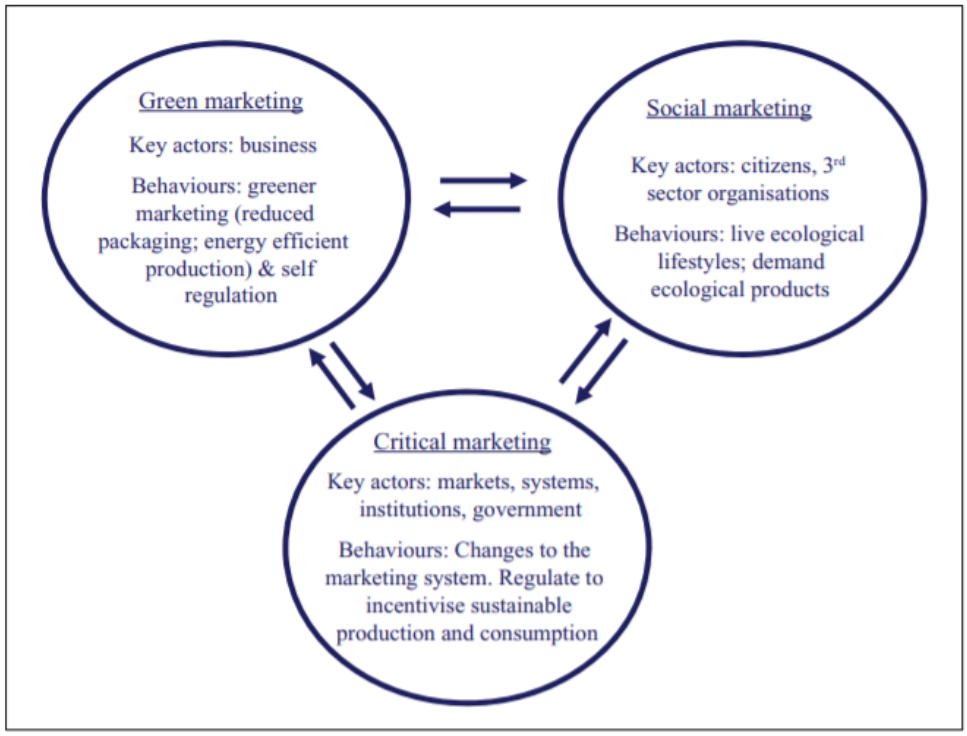


Figure 1. A framework of sustainable marketing

Energy efficiency has various intersections with issues relating to class, race, education, etc. We must ensure that we do not neglect these perspectives and strive to reach various disenfranchised groups that do not always have the means to pay as close attention towards their energy efficiency. We will ensure that our marketing material strives to represent these groups as environmentalism frequently fails to foster a diverse community.

We must also be critical of the institutions that enable us to operate so that we continue to optimize our marketing efforts. Recognizing the limitations of working within a CIO within a university under capitalism will ensure that our work does not sacrifice our principles of sustainability.

Environmental Impact Prototype - Dylan

RMS Metrics of Environmental Impact Prototype

Target	Metric	Initial Ranking	Explanation
★ Effectivity in establishing outreach with students and organizations	Likelihood on a scale of 1-5; 1- uneffective 5- very effective	3	We rank this at a 3. While the environmental impact prototype will be key in carrying out our desired environmental changes, this prototype does not involve as much outreach as the previous prototypes. However, data collection and relationships with local organizations will be key for this prototype and represent a certain level of necessary outreach.
★ Effectivity in engaging with students and organizations	Ranked on a scale of 1-5; 1- uneffective 5- very effective	5	We rank this at a 5. We believe this prototype will give students the necessary steps and resources to actively participate and create sustainable changes in their own homes.
★ Effectivity in creating sustainable changes	Ranked on a scale of 1-5; 1- uneffective 5- very effective	5	We rank this a 5 because this prototype clearly outlines the necessary pathways to creating more sustainable off-Grounds housing here at UVA.

The transition to carbon-neutral buildings has been identified as a multi-step process (Roberts, 2021). As we attempt to reduce the footprint of off-grounds housing, we will keep that process, outlined below, in mind:

1. Reduce the Energy Burden - before we can accelerate the adoption of renewable energy sources, we have to decrease the total energy we use as a society. In off-grounds housing, we can achieve this through processes such as widespread use of LED lightbulbs and the weatherization of residential units.
2. Electrification - we must replace all fossil-fuel burning appliances and HVAC systems with electric options. This eliminates the scope 1 emissions of off-grounds housing, or emissions that occur directly on a property (Huang, Weber, & Matthews, 2009).
3. Secure a Renewable Energy Source - the most imperative step, securing a renewable energy source ensures that off-grounds housing will be carbon neutral.

The above framework will be the basis for all of our efforts moving forward. There are many potential ways to go about each of these steps, and we will touch on these in our Design in Detail section.

Past research has shown that data collection and management is a crucial step in the development of renewable energy infrastructure (Alsalemi et al). Based on this, data collection will be a crucial component of our efforts this semester. We need to understand what the overall system of off-grounds housing looks like, what we can change about it, what changes have already been made to make the system more sustainable (if any), and we need to keep track of all of these (and other variables) to monitor our impact going forward.

The energy audits conducted by the Local Energy Alliance Program are a good launch point. For every property they examine, they keep track of the following things:

- Building information (Conditioned Area, Number of Occupants, Foundation Type, Bathrooms, Year Built, Bedrooms, Number of Stories)
- Heating System (Type, Fuel, Age)
- Cooling System (Type, Age)
- Water Heating System (Type, Size, Fuel, Age)
- Blower Door Test Results

In theory, LEAP would have been able to provide us with these statistics from a variety of conducted audits, as well as any potential audits we coordinate in conjunction with them. Furthermore, LEAP has an extensive energy retrofit plan-of-action they carry out on eligible living spaces. We can monitor the changes they implement to off-grounds housing.

All of this will require the creation of a database. Our plan is to structure the database in the following way:

- Define the Off-Grounds Housing System → We need to fully understand where the boundaries of Off-Grounds living spaces lie. This means keeping track of apartment complexes, houses, and other spaces in the area that will be a part of our efforts.
- Monitor where audits/upgrades happen → We will work with LEAP to understand where they are making progress. We will also look to quantify the reductions of emissions LEAP manages to obtain by working with different residential units.
- Keep track of the Off-Grounds Housing footprint → We have already done some initial calculations to quantify the carbon emissions from Off-Grounds housing, but these can be improved. Furthermore, we want to be able to monitor how our actions are having an impact on that footprint.
- Integrate GIS components → The creation of a map of Off-Grounds Housing would allow us to more accurately keep track of the system. Also, one of our efforts could be in publishing such a map, which would allow members of our organization (and the area at large) to view the status of their living spaces.

Any database we create will undoubtedly utilize spreadsheet software such as Microsoft Excel to keep track of (and analyze) metrics. On top of that, we can integrate ArcGIS software if we wish to create a map component to our database. This software can integrate data from spreadsheets, which allows us to maintain a cohesive structure for our information.

There are already multiple examples of housing and/or sustainability maps for the city of Charlottesville. The City Assessor's office monitors every property in the City of Charlottesville with their map, which includes data on who owns different buildings. The City of Charlottesville also has published a Green Map, that shows different implementations of Renewable Energy Infrastructure.

Our main goal through these efforts is to get a better understanding of (1) the scope/boundaries of off-grounds housing, and (2) the biggest contributions to the sector's energy use and carbon footprints. We have begun to do some rough calculations to determine the former point. According to a study on off-grounds housing (----), roughly 70 percent of the UVA student population utilizes off-grounds housing. Knowing that UVA has a student population of about 25,000, we can say that around 18,000 students live in off-grounds housing. From here, we can estimate based on the average size of an apartment (four students to an apartment) to say that we are trying to reach about 4,500 living spaces in Charlottesville.

We can base our data collection efforts on the above ideas, as well as including some experimentation to identify the best format for use by future members/employees of whatever organization we create. It is possible we will need to develop other methods for improving the sustainability of off-grounds housing, and this will require a shift in our data collection efforts. A potential avenue is the use of a google form sent out to students to have them conduct their own energy audits, which could then be inputted directly into a google sheet. This would be a quick, easy way for us to manage our data collection, and would be able to be passed on to students who are not as adept with computer software (as well as be adapted to fit more complex efforts).

Experimental Design & Procedure

Specific Experiment Procedure Description

We ran a set of experiments this semester to test our prototype and refine our solution design. In this section of the report, we will describe the prototypes, present the experiment results, and discuss the implications.

We began our comprehensive experimental procedure with our hypothesis: *The creation of our nonprofit will allow sustainability efforts in the community to reach students to make off-Grounds housing greener.* (GHC Interim Design Report, pg. 27).

Experimental Procedure

1. ***Coordinate with LEAP to schedule audits*** → this whole project began with coordination with LEAP, and so that is where our procedure will begin. Our team will go through the process to schedule audits at each of our living spaces, which will allow us to analyze the system as outsiders.
2. ***Monitor/Document the auditing process*** → we will collect data and media samples throughout each of our audits. This will serve as the basis for media creation for our marketing campaign, along with the beginnings of a database.
3. ***Recruit other students and stakeholders*** → utilizing the information gathered in steps 1 and 2, we will conduct outreach and marketing to begin forming a cohesive organization. This will be a holistic effort that combines each of the four described prototyping endeavors.
4. ***Build a cohesive organization*** → we will form an organization that will exist beyond our tenure on this project. The organization will have a set structure, and clearly outlined goals that lead to sustainable off-grounds housing.
5. ***Accelerate efforts*** → once we have an organization in place, it's time to get moving. We hope to see a large increase in the volume of energy audits conducted by LEAP, significant improvements made to residential living spaces, and a drastic reduction in the carbon emissions of off-grounds housing.

Experimental Results & Implications of Results

Step 1 Experimental Results

Step 1 was to coordinate with LEAP to schedule audits. Specifically, we sought to go through the process to schedule audits at each of our living spaces, in order to analyze the system as outsiders.

This was where our experimental procedure demonstrated that our current prototype was unworkable. LEAP's funding through the city for free or affordable ~$45 was not renewed for this year. As a result, they told us that they would honor their commitment to doing energy audits for our personal apartments for free. Beyond that, they would not be able to do affordable audits for students.

Step 1 Implications of Results

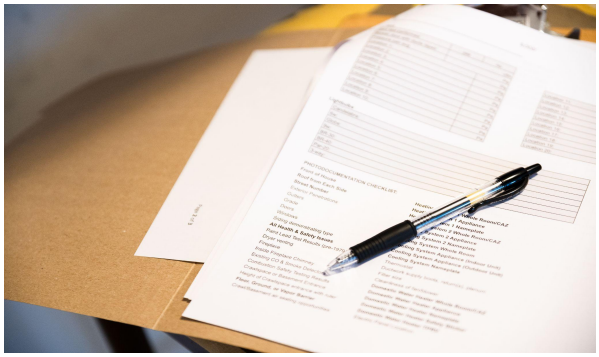
As a result, they allowed us to schedule our own energy audits free of charge but would require most households not meeting highly specific criteria to pay a large fee ~$250. The energy audit setup process was relatively quick and was able to be scheduled after a brief email exchange and filling out of one google form. Luca was able to get his apartment energy audited and photographed the experience. More images can be found here.

These images were shared with LEAP members Erin Morgan and Camryn Fisher for use on the LEAP website and social media platforms. In addition to building further bridges with LEAP, these images can also be used for future GHC media platforms.

Step 2 Experimental Results

Step 2 was monitoring and documenting the auditing process.

The LEAP Audit included:



- Asking about light bulb types
- Photographing model number of heating, air conditioning appliances
- Exhaust fan flow meter tests
- Inspecting sink water pressure
- Blower door test
- Vent flow tests
- IR Camera tests to see where there may be potential air flow leaks

The report they sent following had the information they got during the audit, as well as further recommendations (see Appendix A).

Step 2 Implications of Results

Once the audit was completed and results were sent back, we realized that this process could mostly be done by students in a relatively easy manner. Certain actions like the exhaust fan flow meter, blower door, ventilation flow, and IR camera tests require knowledge and expensive equipment to perform. However, simple and effective tests such as checking light bulbs, sink water flow, and heating unit insulation could easily be performed by students.

As the GHC, it is our role to make this process simple for students to perform themselves, and in a manner that we can easily collect the data on. We therefore decided to create a Google form document that guides students through energy auditing their housing. In addition to this google form, we will create a brief instructional video that will help students conduct this process themselves.

The built-out version of the experimental procedure for the GHC audits can be found in the Design in Detail section.

Step 3 Experimental Results

Step 3 was to recruit other students and stakeholders. In our interim report, we outlined the following broad measures to verify if the prototyped forms of outreach communication have been successful by the end of the semester:

Target	Metric	Current (March)	Acceptable	Ideal
★ Coalition partners	Number of confirmed partners	2	5	10
★ Board of directors	Number of official Board members	0	3	6
★ Financial support	Grants applied for and obtained	0	3 applied for	1 obtained
★ Student engagement	Students who are part of the coalition	8	10	25

We have updated this chart using the same metrics to compare to where we stand at this point in mid-April. Note that the ideal and acceptable metrics are goals for the end of the semester.

Target	Metric	Acceptable	Ideal	March	Actual (as of April)
★ Coalition partners	Number of confirmed partners	5	10	2	2
★ Board of directors	Number of official Board members	3	6	0	Unofficial but potential: 2
★ Financial support	Grants applied for and obtained	3 applied for	1 obtained	0	1 applied for, amount received TBD
★ Student engagement	Students who are part of the coalition	10	25	8	11

We have not yet reached “acceptable” in each outreach category.

For **coalition partners**, we had aimed to have an ideal target of ten, with an acceptable target of two. Coalition partners are organizations associated with the project. We still have only two - LEAP and the UVA Office for Sustainability. I believe I was too ambitious with this specific metric. As earlier prototyping testing steps demonstrated the weaknesses and risks of relying too much on partner organizations, we also recognize that this has less importance in the new design for the GHC.

Concerning the **Board of directors,** we have made meaningful progress. We hoped for three or six committed board members. Currently, three potential board members have been reached out to:

- Ethan Heil - a “Sustainability and Energy Engineer” within the UVA Office for Sustainability, and an expert on green buildings
- Andres Clarens - a professor within Civil Engineering department at UVA, who specializes in Green Engineering
- Leidy Kotz - another professor with the Civil Engineering department at UVA, who teaches courses on integrating systems thinking into the effort to decarbonize

All of the above have responded favorably, demonstrating a successful prototype as it relates to being able to successfully recruit other subject matter experts.

We will be meeting with two potential board members (Leidy Klotz and Ethan Heil) on Friday, April 23rd to discuss details. Therefore, it remains possible that we will hit the acceptable target of three members by May, but unlikely we will hit the ideal of six.

We have actively sought **financial support** for the organization by applying for a grant through the UVA Equity and Environment Fund. This process is described in “Step 5 Experimental Results.” Our application is currently being reviewed, therefore we are unsure how successful this effort has been.

We chose to focus on one grant, rather than applying for multiple. Our ideal target was to receive one grant, and we believed that dedicating time to the specific grant would make it more likely that we would receive it. Instead of putting our eggs in many baskets, so to speak, we instead wanted to maximize our chances with the “egg” we thought was most likely to “hatch.”

We have increased **student engagement** from 8 students to 11. This is above the acceptable target, but below the ideal target. Our student engagement this semester has mostly been a result of connections through Professor Groves. We have had both successes and failures in this.

- We have proven the effectiveness of the GHC at connecting students to resources that can better answer their questions.
    - For example, following a Zoom meeting with Carolina, I was able to connect her to LEAP's solar program. This would be a way for her sorority house to install discounted solar panels during their renovations.
    - We were also able to send our previous research on certification programs to a student interested in having all UVA fraternities undergo a sustainability certification process for their houses. This was a useful connection for the GHC as well, because
- Our student engagement was limited because we cannot formally register as a CIO yet. In addition to the fact that the COVID-19 pandemic has limited in-person events, that has meant that we have not been able to engage with many students. This will become more important - and easier - next year.

We will now discuss more implications of our results from step 3.

Step 3 Implications of Results

These results demonstrate that we have been engaged with all of the metrics for success concerning outreach and recruiting other students and stakeholders. However, the specific targets may have been too ambitious for an organization that is still finding its footing.

The results we have indicate that we should shift away from focusing on partnering with other organizations, but rather increase our attention on financial support and student engagement. Since we have been generally successful with attracting Board members, our strategy for that should remain the same.

As such, we have updated our metrics for outreach for the rest of the semester below, and added a "long term" column.

Target	Metric	March	May	Acceptable	Ideal	Long term
★ Coalition partners	Number of confirmed partners	2	2	2	2	3
★ Board of directors	Number of official Board members	0	Unofficial but potential: 2	2	3	6 max
★ Financial support	Grants applied for	0	2 applied for,	2 applied for	1 obtained	3 obtained

	and obtained		amount received TBD			
★ Student engagement	Students who are part of the coalition	8	11	10	15	25

We have reduced the number of **coalition partners** we hope to have by May. That being said, the long-term goal would have to have three. In addition to LEAP and UVA's OFS, once we are a CIO, we will also be able to engage with the UVA Student Council, specifically StudCo Sustainability. I (Annabelle) have had meaningful conversations with students on this committee before, during the summer and fall of 2020. At that time, there was not much they could do to help the Coalition, although they were interested in it. As a CIO, we will have more leverage to use them in the Coalition.

By May, we hope that all of the people we have approached to be on the **Board of Directors** will commit. However, having two members commit would be an acceptable start. In the long-term, a board would probably have 6 members maximum, not including an alumni member and student representatives.

Given the increased importance of **financial support** going forward, we have increased the long-term to three obtained grants. This would likely translate into many more applications in the long-term.

Finally, **student engagement** has increased this semester above the acceptable target (10 students), but has not yet reached the ideal we had originally intended (25 students). As such, we have adjusted this so that our new ideal target for May is 15 students, and 25 has become a longer-term goal.

Step 4 Experimental Results

Step 4 is to build a cohesive organization. This includes having a set structure, and clearly outlined goals that lead to sustainable off-grounds housing.

Given the results of step 1 and the implications, we have begun to prototype a CIO, rather than a nonprofit association.

We originally believed that a nonprofit association was the best form for this organization for the following reasons:

1. **Limited Costs**- Originally, we believed that the GHC could function as a bridge between community members and students living in off-grounds housing at UVA. When talking with LEAP, we were excited about the prospect of using their energy auditing service to connect UVA students with LEAP's free energy audit program. We believed we could essentially structure our program through these free programs and simply work to connect the community with different students. We did not anticipate having very many costs. In our prototyping section, we anticipated that obtaining financial support would not be too difficult, and obtaining it would be very likely and easy under a non-profit, as we ranked it a 4 in our initial metrics rankings. However, we found out shortly into the semester that LEAP's funding was not renewed, meaning they could not provide free audits to UVA students. While this was a twist in the direction of the GHC, we realized that our initial plan for financial support was not sustainable and, therefore, had to be changed in order to maintain longevity into the future.
2. **Engagement with Community**- We initially liked utilizing the structure of a non-profit in order to emphasize the GHC as a private entity and not one necessarily dependent upon the university. We felt that a nonprofit would provide us with the right infrastructure to operate freely and stay more engaged with members of the community rather than simply stuck in the university bubble. Additionally, we felt that by focusing on our engagement with the community rather than simply starting a student organization would provide us with plenty of services that could be offered by existing organizations like LEAP and C3. Once again, we anticipated more community involvement would lead to more services we could offer to students to ultimately make off-Grounds housing more sustainable. However, through our road-blocks with LEAP and our struggles in operating independently without the assistance of community organizations, we found it difficult to ground ourselves in both the university and Charlottesville community. Additionally, we believed that with UVA intending on expanding on-Grounds housing, it would be a difficult task to create an organization through the university based on improving the conditions of a rival entity. However, we have found so far that this "rivalry" so-to-say has not been evident in any of our interactions. Therefore, we certainly overestimated the difficulty we would have had in creating a CIO through the university.

3. **Longevity and Expansion**- We believed that creating a nonprofit organization was the best way to ensure longevity and opportunity for future expansion of the Greener Housing Coalition. While we recognized the struggles of initially forming our coalition as a nonprofit in the state of Virginia, we believed it would provide us with the necessary infrastructure to operate within the Charlottesville community, obtain state funding, and have the ability to grow as we expand throughout the years. We also wanted to ensure that our board of directors included several dedicated community members who act as stakeholders in the improvement of off-Grounds housing at UVA. This way, we would always have a dedicated board instead of a constant cycling of students. While these thoughts drove our initial plans, we came to realize that there is a lot of effort and planning that is needed to create a non-profit organization. While we are certainly up for the task of putting in the effort, we would also like to expedite our progress and have the GHC operating as quickly as possibly. Therefore, we faced a bit of a dilemma in terms of timing.

Step 4 Implications of Results

Our experiment revealed flaws in the nonprofit association model. As such, we began to reconsider the form of the organization we were building.

We have decided to pursue a CIO instead.

To make clear, we do not necessarily believe that a nonprofit model is completely out of the picture for our long-term goals as an organization. However, due to our heavy reliance upon community organizations for funding and the difficulty in expediting our timeline, we decided that a UVA CIO is a much better organization structure for our current goals. There are many things over the course of our prototyping stage that made us realize why a CIO is the better organization structure for our current status as the Greener Housing Coalition.

1. Time: We came to realize that a nonprofit organization would take a lot of our initial time and effort to become established and recognized by the state. As climate change is a pressing issue and students are continuously moving in and out of apartments, we realized it was crucial to begin making an impact as soon as possible. Switching to forming a CIO will allow us to use our funds to operate as soon as possible and conduct our own audits. We are also currently in conversation with many student council representatives including third-year president Ryan Alcorn, who has expressed interest in helping to expedite our CIO process and getting us approved as soon as possible for next semester. The support from the UVA community to help us become a CIO as soon as possible has led us to switching our design to this new CIO style.
2. Funding: With LEAP no longer providing free energy audits, we realized that we needed to pivot our organization to give ourselves more opportunity for independence. By creating our own audits through a CIO, we give ourselves the power to seek our own funding rather than rely on community organizations for their

services. Additionally, becoming a CIO gives us access to much more university funding than we initially anticipated. Having access to different funding will give us the ability to provide different types of opportunities to students and community members.

3. Student Engagement: We realized that while we want to remain connected with the community, we also would like to be an organization that provides unique opportunities for students. As part of our new CIO structure, we will be using grant money to hire interns to incentivize the longevity of the coalition and ensure that students are working to actively make off-Grounds housing more sustainable. Using a new structure as a CIO will give us the opportunity to directly engage with students who seek to work for the GHC and ensure student participation in the future through this new internship program.

Overall, the implications of these results have caused us to implement a new organizational structure through a UVA CIO. While we plan to use this organizational structure going forward, we also understand that the Greener Housing Coalition could be subject to change.

Moving Forward and Local Inspiration

While we continue to work to grow as a CIO here at UVA, we recognize the importance of analyzing other types of possible strategies for future growth and expansion in the long-term. We recently spoke with UVA alumnus and Forge executive director Andy Page to give us more direction on the benefits of nonprofit organizations, UVA CIOs, and a hybrid organization. Andy currently oversees much of the operations of Forge, which is a hybrid nonprofit/UVA CIO here in Charlottesville that offers programs to students that help them connect with internships and future employers. Andy is very familiar with both the process of creating a CIO along with the process of creating a nonprofit. Forge started as a UVA CIO. However, as the size of the club began to grow, the organization ultimately decided to make the switch towards becoming a nonprofit. It now maintains both statuses each year. Having a CIO status provides Forge with exclusive access to the UVA Activities Fair each year, which is a great marketing opportunity for the company. It also gives Forge access to various different UVA grants. Becoming a nonprofit organization, however, has allowed Forge to increase its donor base, expand out to the Charlottesville community, form more official and legal connections, and most importantly have more freedom in being able to pay its employees.

By utilizing a balance between both of these organization styles, Forge could act as a great model for the future path of the GHC. While we are currently focused on becoming a CIO, future expansion might make becoming a nonprofit organization beneficial to the ultimate goals of our organization. Another interesting point made by Andy that we may take into consideration was the way in which Forge brings in revenue. While most nonprofit organizations are primarily funded by donations, only about 20% of Forge's revenue comes from donations, while the rest comes from earned revenue from the various programs it

offers. This gives Forge more flexibility as an organization and freedom from having to constantly report to its Board of Directors. This is also an interesting point made by Andy, and could certainly be something to consider if more flexibility/revenue is needed within the Greener Housing Coalition.

Step 5 Experimental Results

Step 5 was to accelerate our efforts. Specifically, we hoped to see a large increase in the volume of energy audits conducted by LEAP, significant improvements made to residential living spaces, and a drastic reduction in the carbon emissions of off-grounds housing.

The results from the earlier steps shifted our prototype towards a CIO in which we run our own energy audits. Regardless, we sought to accelerate our efforts. Primarily, we looked for funding sources to be able to offer free energy audits and energy efficiency materials to students.

This was done through the following experimental procedure.

First, we checked to make sure that we could apply for funding as a CIO, and that it would not reduce our chances of being able to acquire a grant.

Second, we began to consider which of the funding sources from our previous research were the most viable to begin accelerating our efforts.

We decided to pursue a grant from the Equity and Environment Fund. LEAP had recommended we look into this grant once they explained the lapse in their funding. Many of the other funding options we had identified were unavailable to us without formally being a recognized CIO. Unfortunately, the process to apply for CIO status occurs during the fall. Fortunately, that means that we will have more options next year. The Equity and Environment fund requires only that a student apply.

In addition, this fund had two important parallels to our existing plan:

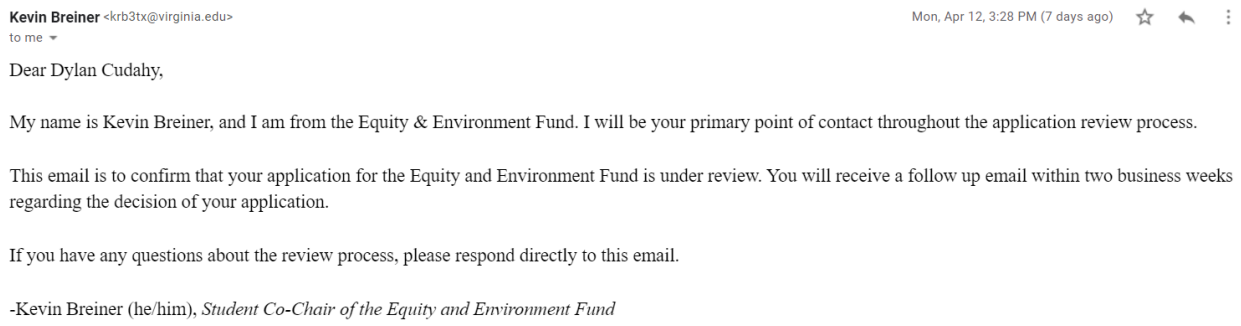
- They had a strong emphasis on student and community partnership. In fact, their virtual information sessions involved an hour of networking with local businesses, community members, and other interested students.
- They had a history of supporting student internships. As such, we decided to pursue funding for a GHC intern (which had been part of our plan from last semester but was expected to be further down the line), in addition to the supplies for energy audits.

A subsection of our application concerning the intersection of equity and sustainability is included for reference (see Appendix B).

Step 5 Implications of Results

We have worked to accelerate our efforts by applying for funding. Unfortunately, we are still waiting for the result of our Equity and Environment Fund application.

That being said, we have received confirmation from the committee and will be notified by the 27th of April.



Kevin Breiner <krb3tx@virginia.edu> Mon, Apr 12, 3:28 PM (7 days ago)
to me

Dear Dylan Cudahy,

My name is Kevin Breiner, and I am from the Equity & Environment Fund. I will be your primary point of contact throughout the application review process.

This email is to confirm that your application for the Equity and Environment Fund is under review. You will receive a follow up email within two business weeks regarding the decision of your application.

If you have any questions about the review process, please respond directly to this email.

-Kevin Breiner (he/him), *Student Co-Chair of the Equity and Environment Fund*

If we do not receive the grant, we will be provided with meaningful feedback from the committee. Without the grant funding, the GHC will have to spend more time over the summer and fall semester fundraising, before we can do many energy audits or hire an intern. This would result in a delay.

If we do receive the grant, it will demonstrate the strength of our prototype, and will allow us to keep accelerating our efforts.

Overall Implications of Test Results

	Experimental steps	Results & Implications
01	Coordinate with LEAP to schedule energy audits	• Scheduled our own audits, but no additional ones will be possible through LEAP • Demonstrated the risks of relying on partner organizations for funding
02	Monitor and document the auditing process	• We were able to document Luca's energy audit • Demonstrated that we would be able to do our own audits
03	Recruit other students and stakeholders	• Progress has been made on outreach • More emphasis will be placed on funding and student engagement, rather than coalition partners
04	Build a cohesive organization	• Challenges with a nonprofit no longer outweigh benefits • Plan adapted to make a CIO
05	Accelerate efforts	• Equity and Environment Fund grant applied for • Awaiting results

Our design appears to be busted as it was envisioned during the end of the fall semester and in the interim report. However, the only step that "failed" was the first one.

We were able to shift the form of our organization while keeping the same mission. We continued on pace with the other steps, although they were modified to reflect what we had learned from the first experiment. Each step of the prototyping process shaped the next.

Although we are still waiting for results of step 5 (specifically, the Equity and Environment Grant), the overall mission and design are still plausible. In the next section of this report, we will compare these results to our critical requirements, metrics and specifications for the project.

Review by subject matter experts

As this project dictated constant communication with subject matter experts and community leaders, we have received a constant stream of feedback.

To begin, here is an email from Lela Gardner, who works in the UVA Office for Sustainability, providing her thoughts on our idea to form a CIO:

Garner, Lela Duncan (ldg6b) Thu, Mar 18, 4:29 PM
to me, Cydnie, Jasmyn

Hey Annabelle,

It was so good to see you on Tuesday! I'm happy that things are still moving forward w/ the GHC. I unfortunately do not have a lot of wisdom on the CIO establishment process, but I do know it is fairly timely and requires a number of interested folks. Cydnie and Jasmyn will likely have more insight (Jasmyn – weren't you involved in the Write Climate CIO founding?).

Being a CIO definitely will not hurt you when it comes to funding. You might have access to more administration-based pools of money, but it shouldn't pull you away from other pools either. I'm happy the E&E Fund is another option too (I'm laughing that we never thought to pursue E&E funding before LOL).

Let me know if you have other questions!

Lela Garner
Sustainability Coordinator
UVA Office for Sustainability
She | Her | Hers

E ldg6b@virginia.edu
P 434.243.5231
M 434.422.6725

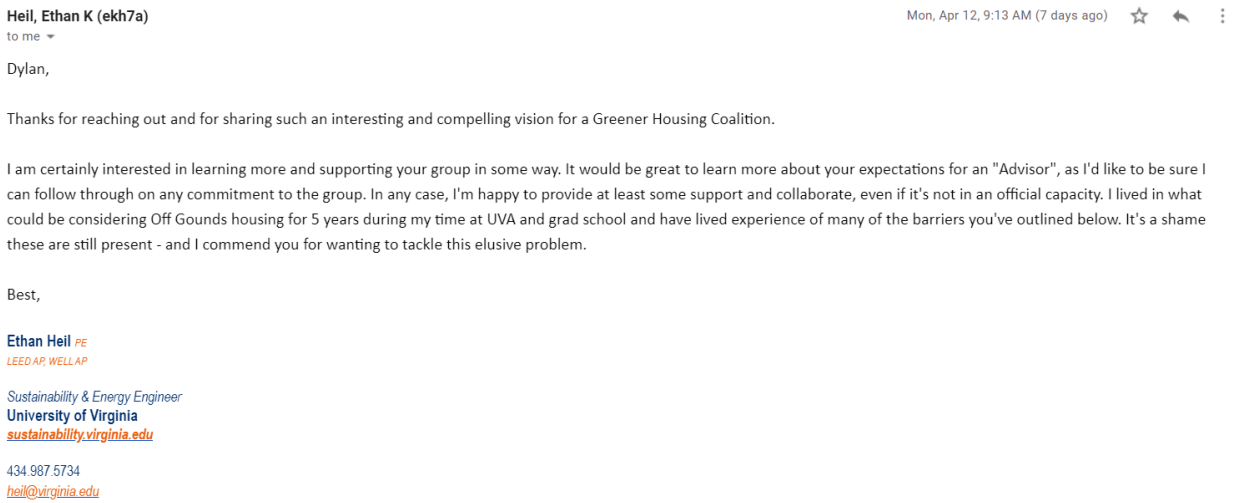
sustainability.virginia.edu

In a networking event sponsored by the Clean Energy Leaders Institute (CELI), I (Annabelle) had a chance to speak with three experts in clean energy engineering. I explained the GHC project and asked the panel what they would recommend if they were designing an energy audit students could easily do. Their advice can be used as feedback to check what we were already planning to do.

Christina Garcia, the Assistant Director of the Building Electrification Institute, recommended the following steps:

- Take an inventory of what happens in those buildings. Figure out what is consuming energy (lights, window ACs, water, heat).
- Then figure out where you can reduce any of it. Talk to the building operator about their schedule. This will provide more information at no cost, more information.
- Turn it into a contest.

Finally, we have provided in-depth explanations of our project to several faculty members at UVA whom we hope to recruit for our board of directors. Each one has responded that they believe this project is well rounded and addresses an important issue. The response from Ethan Heil, who, as stated in the experimental results section, is an engineer with the UVA Office for Sustainability, is a good illustration of this positive feedback:



Heil, Ethan K (ekh7a) Mon, Apr 12, 9:13 AM (7 days ago)
to me

Dylan,

Thanks for reaching out and for sharing such an interesting and compelling vision for a Greener Housing Coalition.

I am certainly interested in learning more and supporting your group in some way. It would be great to learn more about your expectations for an "Advisor", as I'd like to be sure I can follow through on any commitment to the group. In any case, I'm happy to provide at least some support and collaborate, even if it's not in an official capacity. I lived in what could be considering Off Gounds housing for 5 years during my time at UVA and grad school and have lived experience of many of the barriers you've outlined below. It's a shame these are still present - and I commend you for wanting to tackle this elusive problem.

Best,

Ethan Heil *PE*
LEED AP, WELL AP

Sustainability & Energy Engineer
University of Virginia
sustainability.virginia.edu

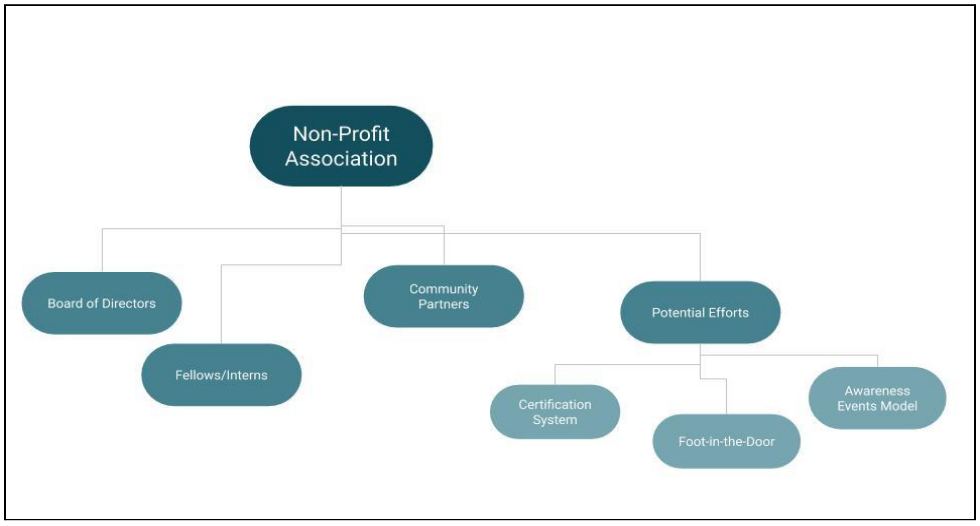
434.987.5734
heil@virginia.edu

Design in Detail

Description of Concept for Implementation

In this section, we will describe how our prototyping efforts have informed the creation of a new solution concept. This concept has yet to be implemented, but rather has been tested against numerous hurdles and industry experts.

The initial organization structure as we imagined it last semester is show in the image below:



The most notable changes from the original solution concept are:

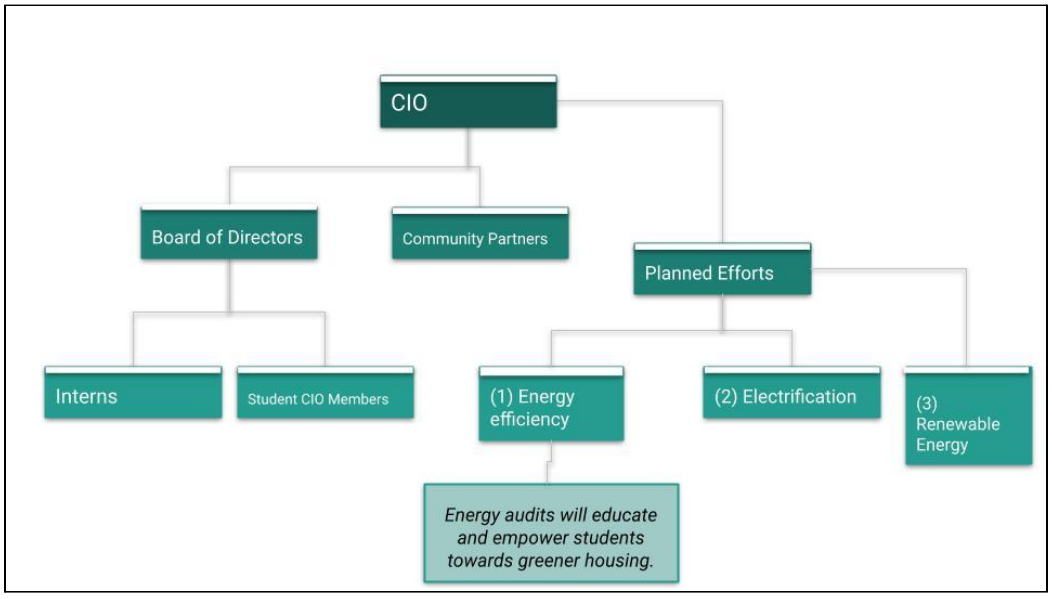
- **The framework of a CIO**
    - Our prototype led us to this shift.
- **Student CIO members**
    - Members will be helpful in attracting other students to the Greener Housing Coalition, enabling the organization to speak with more legitimacy on Grounds, and - most importantly - sustainability-minded students who will be excited to have their apartments audited and improved.
        - This returns to our initial mission statement: “We seek to make sustainable decision-making the norm at the University of Virginia.”
    - This is in contrast to the interns, which will be compensated and expected to report to the Board and communicate professionally with outside organizations.

- Finally, the planned efforts have also been expanded to include the next two stages of our project - **electrification and renewable energy.**
    - These are motivated directly by research on climate action. This three-tenant approach will lead to carbon neutrality.

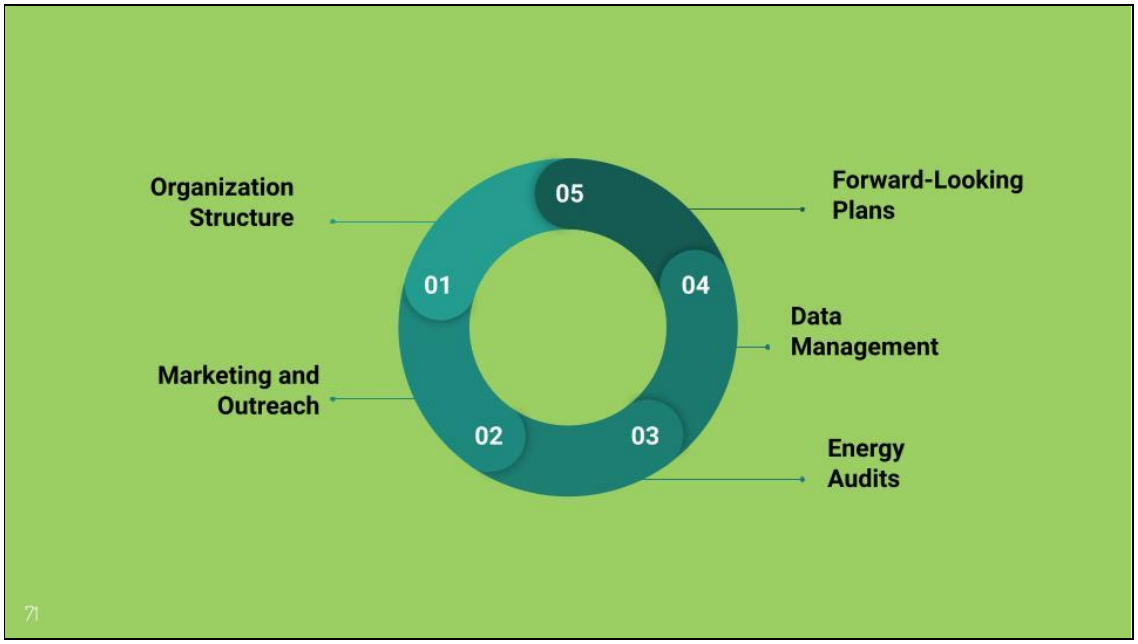
The following aspects have remained in the solution concept:

- **Board of Directors**
- **Community partners**
    - This remains integral to our mission of being good citizens and community members in Charlottesville.
    - We recognize that the expertise of other organizations will be invaluable for students in the Greener Housing Coalition.
- **Initial focus on energy efficiency**
    - While we have added many forward-looking plans (which will be covered in the next section), we ultimately believe that energy efficiency is the best place to start. More can be accomplished in off-Grounds housing quickly and affordably when it comes to lowering the overall energy footprint of student housing.

The new organization structure can be seen below:



Our solution concept can be summarized by the following five initiatives: organization structure, marketing and outreach, energy audit, data management, and forward-looking plans (visualized below):


Organization Structure
01
Marketing and Outreach
02
Energy Audits
03
Data Management
04
Forward-Looking Plans
05
71

(1) Organization Structure

Our initial structure for a non-profit organization, and our structure for a CIO, can be seen above. The similarities between these two design concepts are noticeable.

The CIO will be the vessel that carries out a wide range of initiatives.

We would first note many of the differences between our initial structure through the use of a nonprofit organization and our new structure through a CIO. While in both structures we have planned on utilizing a Board of Directors and Community Partners, our obtaining of funds under this new structure will allow us to act more to directly provide services rather than simply act as a bridge in the community. The Board of Directors and Community Partners will act as "experts" who understand the importance of converting our off-Grounds housing into a sustainable hub and can provide stability and guidance for the student workers below them. We now have a more clear direction with what we can achieve now and where we want to go in the future.

To start, the Board of Directors will be composed of several stakeholders within the Charlottesville and UVA community. We have already recruited several different professors to serve on the Board and anticipate many others joining in the near future. We also hope to have many dedicated community members sit on the Board in order to get their say in plans for the future and have their perspective on how we can operate to optimize our potential in sustainable housing.

The key difference for this style of organization under a CIO will be the employment of student interns. With funds, we will pay several interns to take on many of the large tasks within the organization. As of now, the interns will report to the Board of Directors and help to conduct and organize energy audits throughout the university to help fulfill our first goal of energy efficiency throughout off-Grounds housing. We believe that this will be the most effective way to quickly make meaningful changes for off-Grounds UVA students. However, the roles of these student interns will change as we focus on transitioning to electrification and renewable energy. Overall, the student interns will play important roles in being committed members, taking on some of the biggest tasks under the Board of Directors.

Working along with the student interns will be student CIO members, who will be key in conducting various tasks for the GHC. While the student interns will be paid interns with specific responsibilities to fulfill, the student CIO members will consist of any interested students who wish to make a change in the off-Grounds housing community. The dynamics between the student interns and the student CIO members will help our initiatives be swiftly executed. Additionally, this structure will help provide more clarity to who conducts which tasks and what level of participation will be necessary.

Lastly, with a much more direct method of service through the GHC, we will be able to create a timeline for future progress and goals. While we were simply utilizing services provided by

other organizations as a nonprofit, we now have the ability to provide our own services and set goals for the future. As stated before, while we are currently focusing on energy efficiency as our main short-term goal, we hope to assist in the implementation of electrification and renewable energy for all off-Grounds housing at UVA. The goals we have in line are now much clearer and provide us with a clearer pathway forwards for success.

As such, we have created the following CIO constitution which we will submit to Student Council in fall 2021:

The Constitution of
The Greener Housing Coalition
2021

Article I: NAME.
The Greener Housing Coalition

Article II: PURPOSE (or MISSION).
The Greener Housing Coalition at UVA is established for the expressed purpose of:

1. Recruiting, empowering, and educating our peers to improve the sustainability of their housing
2. Striving to make sustainable decision-making the norm at the University of Virginia
3. In the long-term, we aim to serve as an example of the universal attainability of affordable, sustainable housing

The Greener Housing Coalition at UVA understands school policies and is committed to abiding by said policies.

Article III: MEMBERSHIP.
Members of the Greener Housing Coalition are expected to be students who are passionate about sustainable living. To become a member, one must conduct the GHC energy audit of their housing or attend one Greener Housing Coalition meeting.

- ➢ Members will be added to a listserv/groupme
- ➢ Interests meetings will be open to current and prospective members once a semester
- ➢ General body meetings will be held at least two times a semester

The Greener Housing Coalition at UVA does not restrict its membership, programs, or activities on the basis of age, color, disability, gender identity, marital status, national or ethnic origin, political affiliation, race, religion, sex (including pregnancy), sexual orientation, veteran status, and family and genetic information.

Note: There may be dues/fees associated with being a member of The Greener Housing Coalition at UVA.

Article IV: OFFICERS.

Any member can become an officer after being listed on the official roster for one (1) complete academic semester. Officers shall be elected annually in the Spring semester and shall take office thirty (30) days prior to the end of the semester. All elected officers will be currently registered students.

The officers of this organization will be:

President

- ➢ Calls and presides over official meetings of the organization
- ➢ Maintains organization in good standing with UVA via communication with Student Engagement and/or other interested University entities
- ➢ Oversees the activities of the various departments of the Greener Housing Coalition, marketing and development
- ➢ Maintains ongoing initiatives of the Greener Housing Coalition

Secretary / Officer of Marketing

- ➢ Maintains the official roster of the organization on @UVA
- ➢ Communicates to all members events occurring
- ➢ Maintains official historical file for the organization (constitution, by-laws, minutes, rosters, financial records, risk management, records, etc.)
- ➢ Maintains the social media presence of the organization (Instagram, Facebook, website, etc.)
- ➢ Serves as an ex-officio member of any committee that is created through by-law

Head of Development / Outreach and Financial Officer

- ➢ Maintains accurate ledger and financial records
- ➢ Approves all expenditures from the organization financial account
- ➢ Approves (i.e. signs) all requests for allocations from third-party sources
- ➢ Delivers a financial report to the membership once a semester in Fall and Spring
- ➢ Serves as an ex-officio member of any committee that is created through by-law
- ➢ Promotes GHC at club fairs

The officers will form an executive committee. Although each officer has specific responsibilities, officers and members are encouraged to work together to complete tasks so that no single member becomes overwhelmed at any given time. Executive Board members are expected to meet independently of the general body to plan meetings and events.

Article V: ELECTIONS.

1. **Election Process**: All officers will be elected by the Advisory Board and an oversight committee of GHC founders. Any member is eligible to run for the Executive Board. They

will be asked which position(s) they have in mind. Elections should occur at the end of each year. Officers will have year-long terms. Exceptions will be permitted for students graduating at the end of the fall semester, and studying abroad. This will trigger a special election for this specific position.

2. **Removal**: Any officer in violation of the Organization's purpose or constitution may be removed from office by the following process: a. A written request by at least three members of the Organization. b. Written notification to the officer of the request, asking the officer to be present at the next meeting and prepared to speak. A two–thirds (2/3) majority member vote is necessary to remove the officer.

Article VI: MEETINGS.

Meetings will occur at least once a month, but meetings may occur more frequently depending on member interest and on what the President deems necessary. The date of the next meeting will be agreed upon at the end of each meeting and will be included in the Secretary's minutes of the meeting. For a standard meeting, half of the active members are required for a quorum. Two-thirds of the active currently enrolled members are required for an election meeting.

Article VII. BY-LAWS.

By-laws will be created to dictate the structure and procedures of the organization. By-laws may be proposed by any member and must obtain a majority vote of the membership. No by-law shall infringe on the authority of the constitution. Required by-laws, which shall be ratified, include:

- ➢ Organization of committees for specific events/projects when deemed necessary.
- ➢ Parliamentary modification (ratified at first meeting of a new executive board's term)
- ➢ Election of officers

Article VIII. COMMITTEES.

Committees of the organization may be created from time-to-time by the executive board in order to organize and distribute the workload of the organization. Committees shall be governed by by-law and shall not have authority over the executive board or the general body. Any active member (including the officers) may serve as a committee chair. Committee chairs will be appointed by the President and will coordinate the planning and execution of the committee project. Any number of active members may be on a committee.

Article IX. ADVISORY BOARD.

1. If our organization deems it necessary or desirable, one or more University of Virginia faculty, staff, alumni, or graduate student can serve as an advisor
2. Advisors will be approved by a majority vote of the student executive board
3. Advisors will be asked to attend meetings with the executive board twice a semester to receive updates on the initiatives of the Greener Housing Coalition.

At this time, advisors can provide any insight/advice to help direct the efforts of the GHC.

Article X. STUDENT INTERNSHIPS

1. If our organization deems it necessary or desirable, one or more University of Virginia students will be hired to serve as a student intern.
2. Student Interns will be interviewed by the executive board and/or advisory board, and will be hired pending a majority vote of the executive board
3. Student Interns will be given specific tasks and responsibilities that require both a larger time commitment and field-specific knowledge than is expected of an executive board member. The fulfillment of these tasks will be overseen by the executive board and reported to the advisory board
4. Student Interns will be paid at a rate consistent with student internships offered by the University of Virginia

Article XI. AMENDMENTS

The constitution is binding to all members of The Greener Housing Coalition, but the constitution is not binding unto itself.

1. Amendments to the constitution may be proposed in writing by any active member of The Greener Housing Coalition. Amendments should be submitted to the President, who will then designate time for discussion of the proposed amendment at the following full-body meeting.

2. Proposed amendments will become effective following approval of two-thirds (2/3)-majority vote of active executive board members.

(2) Marketing and Outreach

Our outreach efforts have been the most successful of any initiative this semester. We will continue to identify and recruit more members to our organization. That being said, as our organization grows, we will need to rely more on marketing efforts to do our recruitment for us.

Because the GHC experienced a number of setbacks and was not able to form a coherent organization, marketing efforts have not yet taken place as there was not available material for us to market. However, as the GHC has shifted its focus to accommodate for these setbacks, the content that we ought to market has become much more clear.

As we are now asking students to conduct energy audits of their own housing, our social media must take an educational approach. Students must not feel as if the audit process is overly complex, or that potential solutions feel too far out of reach. Focusing on simple tasks like changing light bulbs represent easily identifiable ways for students to make clear changes to the carbon footprint of their housing.

Creating a brief instructional video on how to properly fill out the GHC Google Form for energy audits will be a great solution for students who may feel as if the process is too daunting. Because we will be creating this video specifically for our Google form, it will be able to clearly outline each question and how to produce the most accurate results for our data collection.

GHC social media content can focus on getting students educated on their home carbon footprint and how to address it. Photo-centered posts detailing the different types of lightbulbs available, how to weather seal leaky areas, checking faucet pressure, etc. will be crucial towards building the base of knowledge amongst students as not everyone will take the time out of their day to watch the instructional video and complete our form. Photo posts with well-structured text and graphics will be able to instantaneously communicate information and can be easily shared by people on social media so that our reach extends beyond our follower base. Shorter instructional videos on more specific topics regarding our energy audit process can also be created utilizing footage from our longer and more thorough video.

Our marketing strategy will include maintaining a consistent aesthetic composed of the colors present in our GHC logo. Because our primary social media platform will be instagram, the appearance of our material will be equally as important as the content it contains. In order for our content to be shared, people must be happy with the aesthetic it represents as it will be present on their own social media feeds.

Instructional video:

GHC member(s) will host the video and Luca will film and edit the video before the end of the semester. It will take place in one of the members' homes.

The video will start with a brief introduction of the contents alongside timestamps in case students wish to quickly jump to a specific portion of the video. The video will include the host going over the GHC Google Form to properly mirror the experience.

To properly ensure viewer retention, the video will start with the more identifiable and easy-to-complete section of the energy audit which would be lightbulbs. The video will include how to identify which type of lightbulb one has and give brief information on the type. It will then go over when/how to replace it and why one should replace it with LEDs. In the future, the video will also include information on how to receive replacement bulbs from the GHC stockpile if this becomes a reality.

Following the Google form, the video will include how to identify your heating system and link information to learn more about what kind of heating your house has. It will then do the same for an air conditioning unit as well as a water heater. The water heater section will include a brief portion on how to install an insulation blanket to increase its efficiency.

The video will then go into composting, what it is, what the benefits are, and how to create your own compost bin. Recycling will be the final part and will cover how to properly recycle your materials if your housing does not have accessible recycling bins, as well as tips for making this process easier.

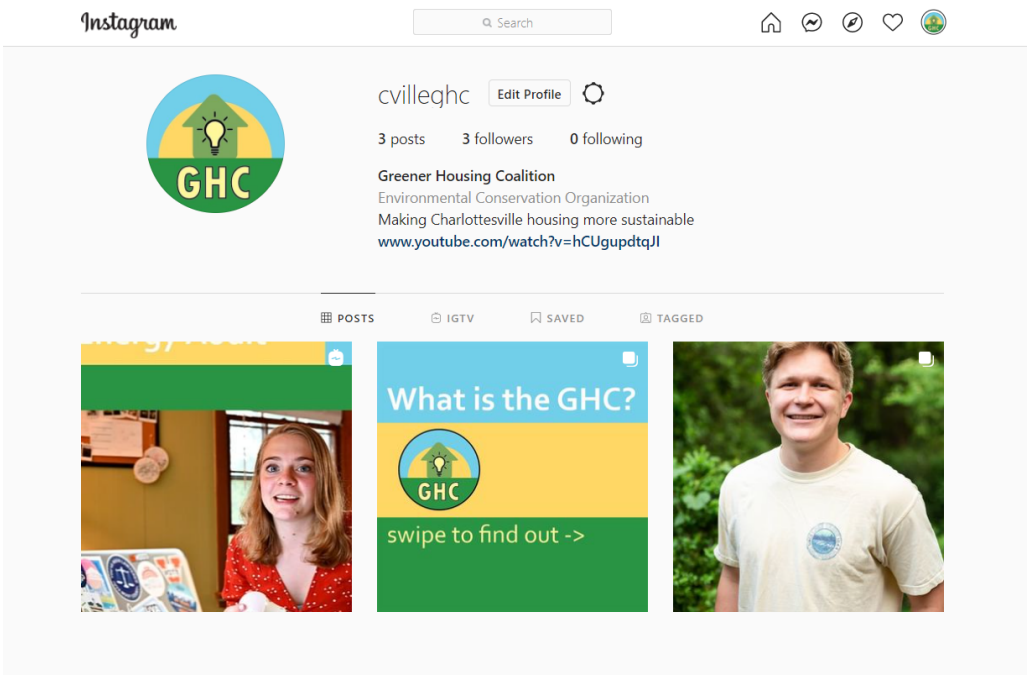
If the GHC successfully receives the grant money possible to purchase bulk quantities of energy-efficiency technology that can be distributed to students, supplemental video material could be created to make this process more understandable.

Completed Instructional Video:

https://www.youtube.com/watch?v=hCUgupdtqJI

GHC Instagram:

https://www.instagram.com/cvilleghc/



(3) Energy Audits

We are still convinced energy audits are a great way for our organization to gain traction. We have developed our own process, based on the one created by LEAP, to send out to students. The audit is a google form, which is able to be filled out by any student living in off-grounds housing. We intend to revise this audit heavily before we implement it on a large scale, including having subject matter experts review what we have created.

The energy audit will allow us to examine where the biggest changes need to be made to improve the sustainability of off-grounds housing. Furthermore, we hope to bring students' attention to the choices they are making on a daily basis that can drastically affect their carbon footprint. We also hope to eventually have GHC leaders conduct in-person audits, and the information gathered from this online audit can inform how we go about that large initiative.

A preliminary sketch of the google form energy audit can be accessed **here** and is included for reference (see Appendix D).

(4) Data Management

In the early stages of the GHC, our data management efforts will be closely coupled with our online energy audit. The aforementioned google form sends the results to a Google Sheets file. This way, we are easily and effectively keeping track of students' responses. As we progress, we can refine the google form audit to provide use with more specific information. This will allow us to categorize students' responses, and begin to understand where the biggest problems with off-grounds housing lie.

As stated in the definition of our challenge space, we believe off-grounds housing has a level of emissions equivalent to 50 to 60 percent of the University's. However, this is a very rough estimate. We hope our energy audit will allow us to further quantify this component, as we will be able to better identify the energy use habits of students, along with the makeup of utilities and appliances in their homes.

Moving forward, we hope to create a larger dataset, where we examine student living spaces before and after changes are made to improve their energy efficiency. We want to be able to look at the footprint of a living space, and definitively say how much we (1) reduced their energy bill, (2) reduced their energy use, and (3) improved their carbon footprint.

One further mechanism we intend to utilize is the collection of utility bills. While some students pay a flat rate for their utilities, others receive detailed bills that show both how much they owe and how much energy they use. If we pair this with the data collected by our energy audits, we will gain a better understanding of the problem space and how best to address it.

Google sheets is a relatively simple way to manage this data, but the advantage here is accessibility. By refraining from adopting complicated data management solutions, we maintain a wide pool of possible candidates to fill positions within our organization. Furthermore, the online platform is a great way to preserve institutional knowledge in the event of member turnover.

An example of our initial data collection efforts is included for reference (see Appendix C).

(5) Forward Looking Plans

Future endeavors of the Greener Housing Coalition should focus more on the substantial reduction of emissions from off-grounds housing. These efforts should focus on the process mentioned on ---: reduce energy burden, electrification, secure a renewable energy source.
There are numerous low-cost solutions to reducing home energy burdens:

- **Energy Audits** – these are a simple, effective way to determine the relative footprint of a residential unit.
- **Collect Utility Bills** – by examining utility bills, we can further improve our understanding of the challenge space.
- **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 options 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 home
- **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.

Our initial idea for the next step of the Greener Housing Coalition is to focus on LED lighting. A surprising number of students still rely heavily on incandescent bulbs. By replacing as many bulbs as possible with LEDs, we could see a drastic reduction in emissions. We would include any bulbs we replace in our data management efforts, allowing us to keep track of the amount of emissions we remove from off-grounds housing purely by improving lighting efficiency.

But moving forward, The GHC should think big. The larger the membership base, and the higher the funding, the more ambitious projects the GHC can take on. Keeping the above three-step framework in mind should be the guiding principle as we seek to improve the sustainability of off-grounds housing.

Design as an Embodiment of Requirements

We had seven critical design requirements from our second team report (GHC Generate and Select Report, pg. 52). All of our solution concepts had been ranked based on a weighted rating of how well they were likely to fulfill the requirements. We have included them below in the order in which they were originally ranked.

For each, we will describe briefly why we believe them to be important requirements. Then will demonstrate that our current solution design embodies each requirement.

1. Sustainability

Reducing the amount of carbon dioxide among students is the primary goal of our many solutions. It seems the majority of students come into college with poor energy usage habits. Reducing carbon per student is of the utmost importance.

Sustainability remains our key objective, although we have expanded into a more nuanced and complete view that includes all three pillars of sustainability (refer to pages 2-4 of this report for details). The GHC student-led energy audits fit right into this requirement. Our audits will empower students to have more sustainable living situations, and will educate them on how they can be sustainable in any living space. Students can take the knowledge with them one they know how to do an energy audit on one's own apartment, buy greener materials, and reduce their energy use. This will lead to emissions reductions from off Grounds housing, and from UVA students in their future energy use.

2. Engagement

To make a real change it only takes a small portion of a population. We don't need everyone to make household changes, but we do need a select few to enact change.

Our design will bring meaningful engagement. First, the Board of Directors will be composed of experts who are already passionate and knowledgeable about greener housing. Second, employing interns will ensure that these students engage and benefit financially. Finally, having CIO members will facilitate further engagement that may be less intense, but which will complement the efforts of the Board and the intern.

3. Affordability

Since all of the possible solutions mentioned are targeting college students the amount of money coming out of the students pockets is pivotal. A solution that requires a large sum of money is not one designed for most college students and therefore is not effective.

Our current design will be affordable for college students. We hope to use funding to cover the costs of energy audits, and to charge a small amount for dues, such as something under $20 per member.

4. Landlord support

The amount of students who live off grounds and are renters is exponentially higher than college home owners. Therefore the support of landlords is a necessity in most solutions mentioned.

While we were previously concerned that it would be more difficult to get landlord support with a CIO rather than a nonprofit organization, having a professional intern and Board of Directors will serve as a way to counteract that concern. In addition, the student energy audits will not require landlord approval, and the students in the CIO equip students to approach their landlords with larger recommendations.

5. Accessibility

Both time and effort are important for our solutions. How easy is it to attain the goal? Is the pay off worth the trouble of installment?

Every change made to our design following the prototyping results will make it easier to attain our goals. For example, a CIO will require less upfront costs to start. The energy audits may be expensive to fund, but hopefully grants will cover that cost and we will be able to offer to students a highly accessible service.

6. Practicality

College students do not have a lot of free time. Whether it be academics or athletics time is of the essence. Therefore, a solution needs to be time sensitive.

Similarly to accessibility, practicality has remained important throughout our process. We believe our updated design is highly practical. We have designed energy audits that are both educational and easy-to-understand. Hundreds of CIOs operate on Grounds with large student bodies, financial support, mentorship, and social media marketing. They also make sizable differences in both the life of students, as well as the community we are all in. We believe the Greener Housing Coalition CIO is therefore practical as we are currently envisioning it.

7. Outreach

The amount of students we can influence is very important. We don't underestimate the power of a few like minded individuals but in order to make a change on our campus we need to get as many people enlightened about the issue as possible.

Finally, outreach has been a consistent theme throughout this project. Our current design embodies outreach as we will have ongoing connections with mentors, organizations in the community, and students. Marketing, a new component this semester, has increased just how effectively our design will be able to pursue outreach.

Reflections on Design Thinking

Assessment of Design Viability

Team Reflection

We believe our prototype is viable for four reasons.

1. First, we have had high levels of engagement, both with students and experts.

2. Second, we have received positive feedback from experts and independent assessors. As such, they have been interested in the project, provided feedback, and are willing to help. Our ability to recruit a board of directors speaks strongly to the viability of this idea. Ethan Heil is both an expert on the sustainability of buildings, energy improvements, and works with UVA students. His support has demonstrated that we are relying on the right sustainability and engineering process. Lela Gardner

3. Third, our energy audit process is put together. It is quick and painless to input as a student and find the information in your apartment. This translated to a successful data collection for GHC records.

4. Fourth, our design reflects our mission statement. Our mission was to recruit, empower, and educate our peers to improve the sustainability of their housing. We strive to make sustainable decision-making the norm at the University of Virginia. In the long-term, we aim to serve as an example of the universal attainability of affordable, sustainable housing. Our design achieves this goal by showing students what they can do on their own to become more sustainable, while collecting data to better understand the trends and carbon footprint of Off-Grounds housing.

Challenges remain but can be realistically and sustainably overcome.

1. Split incentives remain problematic in the mission to reduce off-Grounds emissions. It is critical to bridge the gap between students and landlords. While we have focused on the initiatives students can take without requiring landlord permission, many of our future projects will face this challenge head-on to work *with* landlords. We will demonstrate the economic and environmental benefits to making energy retrofits and installing renewable energy sources. It is realistic to say that the Greener Housing Coalition, as a professional and credible organization, will have more sway and leverage with landlords than individual students.

2. While funding has been a challenge, receiving it remains possible in the future but is not necessary for our efforts. Our experience with funding has demonstrated that it will be a time-intensive part of the project, but that it is not impractical to undertake. As our network expands, it will become easier to find more funding streams. Even without the Equity and Environment Grant, our project design is resilient and can operate by providing free educational sources to students and developing data.

3. There are formal and time-constraint barriers that have prevented us from becoming a CIO. We are prepared with a CIO Constitution and Instagram plan. Once the timing lines up, this will be a quick process.

4. Our future plans for our organization structure remains promising following our prototyping efforts. While our prototyping process has changed to make a CIO in the short-term, the ability to become a nonprofit in the longer-term remains plausible. This would follow the model of Forge, which operates as both. Being a nonprofit has enabled them to have a larger donor base, work in the Charlottesville community, and pay their students easily, while their CIO status connects them to the University. The Executive Director of the Forge confirmed that it takes 8-14 months for the paperwork to go through to become a nonprofit. That demonstrates that this would not have been viable for our project in the short-term. In addition, we could still partner with LEAP to bring a high enough volume of customers to negotiate a better rate for audits and energy improvements.

Recommendations going forward

1. Initiatives: Work with stakeholders and industry experts to identify ways to reduce the energy burden of off-grounds housing. Monitor the process of the Greener Housing Coalition to optimize energy reduction per dollar spent. Potential initiatives could include:
    - The creation of a sustainability metric to allow potential renters to easily compare the energy efficiency of different properties.
    - An effort to reduce the number of incandescent lightbulbs used by students
    - Working with larger student-occupied houses to conduct deep-energy retrofits

2. Funding: Continue to look for different grants offered by the University. In the long-term, focus on becoming more autonomous. Look into developing sources of revenue, such as CIO dues, raffles, or ticket events.

3. CIO: Work with student council members to learn more about the process going forward. Apply for CIO status as soon as possible and make sure to renew status every year. Make sure to structure organization in such a way to ensure longevity of the program.

4. Nonprofit: Keep the scope of becoming a nonprofit organization on the horizon. As the GHC expands, it is worth looking at the opportunities to expand beyond the UVA community and into the greater Charlottesville community. Keep in touch with experienced nonprofit directors such as Andy Page to seek guidance in eventual transition to hybrid CIO-nonprofit structure.

5. Stakeholder engagement: Expand to work with partners and other organizations such as C3 for single events and projects.

6. Student engagement: Target venues and events to sign up more students for energy audits. Examples include the activities fair, off-Grounds housing fair, and UVA sustainability events.

Recommendations

Annabelle's Reflection and Recommendation

I am proud of how this project has progressed, evolved, and improved throughout the year. I learned a lot about the outreach side of sustainability, how to decide what type of organization to build, and how to go about building it.

What would you change about your specific design activities?

If I could start over, I would choose to spend more time concentrated on outreach to other students and other student organizations. While the enthusiasm and positive feedback from experts has been affirming and helpful, the success of this project now ultimately turns on the involvement of the students starting the CIO and those who join. Having a listserv with more students and circulating the name GHC around Grounds this semester would definitely have been a way to boost what will need to be done next semester. That being said, the prototyping stage convinced us to shift to a CIO in the short-term, where student engagement matters more than we originally thought. As such, the outreach focus on partners and stakeholders did seem like the correct choice in the fall and beginning of the spring. This semester the outreach efforts did adjust to focus more on talking with students who were looking to improve their residential emissions off-Grounds. However, these calls were focused on how we could help them, rather than convincing them to join the GHC.

On the design thinking process specifically, I would have liked to spend less time preparing solution concepts and more time prototyping as a way to choose the best concept. I thought the challenge definition was a useful framework for understanding the stakeholders and problem space, and that the design in detail was imperative for making this viable for the next semester.

If work on this project continued, what you would recommend as next steps?

When work on this project continues, I would recommend three things. First, make outreach more casual to attract students. Second, chase an ambitious goal for audits done next year.

Regarding outreach, I would recommend a two-pronged approach. When it comes to building out the CIO, I think outreach will need to resemble marketing more than anything else. Student engagement will depend on Instagram presence, Facebook ads, and flyering. However, outreach regarding recruiting new board members and managing existing ones should continue to be more professional than other college organizations may be.

Energy audits have always been a component of this project. They have become even more important following our experimental procedure and as we become a CIO. As such, I hope the team makes ambitious goals to do 45 energy audits, and I wish them the best of luck.

Bryce's Reflection and Recommendations

What would you change about your specific design activities?

While I worked primarily on investigating the optimal type of organization for the GHC, going back, I would want to contribute by, early on, creating a clear and simple way for us to collect and monitor data. While I feel that we made great progress this semester, going forward, data will be what allows us to understand and reach our goals. Therefore, I think I would have liked to work more on understanding how to create a database or accurately and easily store our information. This is ultimately the foundationary infrastructure to our future goals and it is a crucial component for years to come. I also would have liked to hold more directed discussions with community members to find out about optimal organization styles. My meeting with Andy Page was very positive and I felt that I could have certainly used guidance as we decided to switch from a nonprofit to a CIO.

If work on this project continued, what you would recommend as next steps?

There are several next steps for the Greener Housing Coalition. As a start, applying for and achieving CIO status will be essential for relevance as a legitimate organization, so this should be a priority. Additionally, the GHC should focus on beginning to conduct as many audits as possible. The auditing process will not only help improve off-Grounds sustainable housing, but it will also start to provide us with data that can inform us on our next steps going forward.

Reflections

While I was only part of the team for this past semester, my experiences in working on the prototype and testing portion of the design process have really helped me understand how the design process works and the necessary measures to take an idea to the next level. Starting with the prototyping stage, developing a concept design for our organization certainly was not easy. We bounced many different ideas around until ultimately deciding on the nonprofit structure as the most optimal structure for the GHC. What is great about the prototype section, however, is that it truly is just a prototype. With a lot of directed research and unforeseen changes, we decided that a CIO would be best for the GHC. From participating in this prototype process, I learned that it is okay to admit to change and take a few steps back. While we had made a lot of progress on our nonprofit structure, we understood that it would be much more useful to become a CIO in the short-run. Therefore, we chose this route and went against our prototype. The next part of the design process is testing. While we certainly could test the effectiveness of many parts of our organizations including the way collect data and our outreach efficiency, it is a bit difficult to track quantitative data for an organization that has been built around human conversations and interest rather than numbers. I think that "testing" could have been used much more loosely for our type of project, but I still appreciated learning about how even an organization could test for effectiveness.

Luca's Reflection and Recommendation

I was very happy that I chose this group. Although the scope of our project shifted significantly throughout the semester, our commitment to communication and problem-solving helped us push through roadblocks and I look forward to the future of this organization.

What would you change about your specific design activities?

If I had the chance to go back in time, I wish that I could have started marketing efforts much sooner. In order to do this, we would have had to create an established structure for the GHC that did not rely on the LEAP grants to conduct student energy audits. This way, regardless of how we were able to achieve funding, we could have begun to make students aware of our organization and our goals throughout the semester. The initial structure of our organization was too heavily dependent on the involvement and resources of LEAP, and when this connection did not play out properly, we were forced to completely restructure.

If work on this project continued, what you would recommend as next steps?

Promoting our energy audit video and further developing our social media presence are going to be crucial for the GHC to succeed in significantly reducing the carbon footprint of off grounds housing. One the GHC is established as a CIO and begins to receive submissions of our energy audit Google form, we may have to modify this process as we gain a better understanding of how the self-audits work at a larger scale. This may require the shooting of a new instructional video, or supplementary educational material.

Recruiting new members for the GHC must extend beyond social media alone. Working with related organizations and promoting our efforts throughout other events will be crucial to growing our organization's popularity. Having an established presence at the CIO activities fair and the off-grounds housing fair will help recruit students once in-person events are back to normal. Pop-up events near first-year housing could also be beneficial as many first-years plan on living off-grounds throughout the rest of their time at UVA.

Although UVA will continue to prioritize students living on-grounds, the fact that many will choose off-grounds housing will continue to be a reality. Working with UVA can also be an option for the GHC as they will likely help contribute to our goal of helping make Charlottesville a more sustainable city. If we are able to get an established presence on the off-grounds housing website that many students use to find housing, we can help promote more sustainable housing options and solve the split incentives issue present with the property owners.

Continuing to ensure that our energy audit process is efficient and accessible, working with UVA and other organizations, and using the gathered data in ways that incentive sustainable practices are the best methods to ensure that the stated goals of the GHC come to fruition in the years to come.

Dylan's Reflections and Recommendations

What would you change about your specific design activities?

I am proud of what we have achieved, but I felt that I had a hard time implementing clear-cut engineering concepts this semester. In conversations with the Office for Sustainability, LEAP, and other entities, there seemed to be a disconnect on how to improve off-grounds housing other than to increase community engagement. The Energy Audit we created was a step in the right direction, along with some of the proposed concepts.

If I could go back and redo my efforts, I would delve deeper into how to work around LEAP. Their services are invaluable, but because we were coupled so closely with them we were hamstrung in the final stages of this project. All of our efforts focused on how to bring the LEAP offerings to a wider audience. We did learn a valuable lesson on how to adapt, but detaching ourselves from LEAP might have allowed us to create a more tangible solution concept. That being said, with the information we had at the time, I do not think I would have done anything differently.

Finally, I believe we could have adapted the design thinking process to better suit our needs. While the exploration in every stage of this project gave us a thorough understanding of the challenge space, there were times that felt as if we were doing extensive research just to verify what we already knew. I believe that I personally was more focused on the reports than the actual organization. That being said, I do not think we would have landed on our current solution concept without a design thinking process, but now it is time to put together the organization and let the process of running it yield the next steps.

If work on this project continued, what you would recommend as next steps?

When (not if) work on this project continues, it is time to start reaching out to a wide range of students. As I said, everyone seems to think that what is required to attack this project is a lot of engagement. The solutions exist, now it is time to implement them.

I believe the GHC can benefit from working relationships from organizations such as LEAP. No, we can no longer utilize a grant program to conduct discounted energy audits and retrofits, but maybe we can get some sort of bulk discount. Most people at UVA who we have talked to have mentioned LEAP, and so further exploration is needed here.

The integration of GIS components to the GHC could allow us to more effectively collect data. Furthermore, publicizing information on different housing situations could allow students to become informed consumers. I will mention that if we are not able to secure a student intern to do this work that I may be able to accomplish this task, as I recently completed a course in GIS methods.

Lastly, I believe the GHC needs a working relationship with landlords and/or building owners. Why work with one apartment when you can address an entire complex? This task can be facilitated through the integration of GIS tools, which can help identify who we need to reach out to.

References

Note: All graphics are made by the Greener Housing Coalition unless otherwise cited.

Challenge Space Definition

Annabelle's Sources

Reports

"UVA Greenhouse Gas Action Plan." Energy Strategy Task Force, compiled by Pettit, Andrew. *Sustainability UVA*, May 2019, sustainability.virginia.edu/sites/sustainability/files/2019-08/UVA_GHGActionPlan_05152019.pdf.

"2016 Greenhouse Gas Inventory City of Charlottesville," March 2019, *City of Charlottesville, Department of Public Works, Environmental Sustainability Division, Climate Protection Program,* https://www.charlottesville.gov/DocumentCenter/View/3013/2016-GHG-Inventory-PDF

"Albemarle County Climate Action Plan Draft," Winter 2020, *Albemarle County*, https://www.albemarle.org/home/showdocument?id=3182

Online Resources

Brailsford and Dunlavey, "Episode 18: University of Virginia's Delta Force Program." May 2, 2019. *Campus Energy and Sustainability Podcast,* https://www.campusenergypodcast.com/blog/2019/university-of-virginia-delta-force-program?r=uva

"Climate Action & Energy." *UVA Sustainability*, University of Virginia, sustainability.virginia.edu/steward/climate-action-energy.

eGRID Summary Table 2018, USEPA, accessed on February 20, 2020, cited in *Albemarle County Climate Action Plan Draft*, at https://www.epa.gov/sites/production/files/2020-01/documents/egrid2018_summary_tables.pdf

"Green Labs," *UVA Sustainability,* University of Virginia,

https://sustainability.virginia.edu/programs/green-labs

"Green Workplace", *UVA Sustainability,* University of Virginia, https://sustainability.virginia.edu/programs/green-workplace

"Home Energy Challenge," *Cville Challenge*, https://www.cvillechallenge.org/

"Household Incentives," *The Community Climate Collaborative*, last updated April 1, 2020, https://theclimatecollaborative.org/household-incentives

McGowarn, Elizabeth. "Charlottesville Program Pairs Housing Vouchers with Energy Efficiency Funds," July 19, 2019. *Energy News Network*, https://energynews.us/2019/07/19/southeast/charlottesville-program-pairs-housing-vouchers-with-energy-efficiency-funds/.

"Renewable Energy Tracker," Updated daily, *University of Virginia Facilities Management,* https://renewableenergy.fm.virginia.edu/

Sampson, Sabrina. "Eco-leaders Program Offers Opportunities for Action." December 16, 2019.
UVA Sustainability, University of Virginia, https://sustainability.virginia.edu/eco-leaders-program-offers-opportunities-action

"Shut the Sash," Google Form, 2020, *UVA Sustainability Green Labs Program*, University of Virginia, https://virginia.az1.qualtrics.com/jfe/form/SV_3lc7EvgbIWQtYa1

Turner, Narissa. "Climate Action Together: Advancing Climate Action in Charlottesville-Albemarle-UVA," https://spark.adobe.com/page/NRk9LWtoq8gqk/ https://spark.adobe.com/page/NRk9LWtoq8gqk/

"Wahoos for Sustainability," https://www.wahoosforsustainability.com/

Wrabel, Alison. "Albemarle Adopts its First Climate Action Plan," October 7, 2020. *The Daily Progress.*
https://dailyprogress.com/news/local/govt-and-politics/albemarle-adopts-its-first-climate-action-plan/article_2dcaf478-08d7-11eb-bcb2-5fe4b5eb5011.html

Meetings

Green Greeks, October 17, 2020.
City of Charlottesville Sustainability, October 16, 2020.
Lela from UVA OFS, October 5, 2020.
LEAP + OFS, September 23, 2020.

Green Leaders, September 13, 2020.
Student OFS Employees, September 6, 2020.

David's Sources

Online Resources

"Blower Door Tests." *Energy.gov*, www.energy.gov/energysaver/blower-door-tests.

"Current UVA Green Building Standards." *UVA Sustainability*, sustainability.virginia.edu/resources/current-uva-green-building-standards.

"Home - LEAP: The Local Energy Alliance Program." *LEAP*, 2020, leap-va.org/.

"Home." *Pearl Certification*, pearlcertification.com/.

"Light Bulb Efficiency." *Light Bulb Efficiency | Center for Nanoscale Science*, 2019, www.mrsec.psu.edu/content/light-bulb-efficiency.

"Replacing Your Water Heater." *Replacing Your Water Heater | Smarter House*, 2018, smarterhouse.org/water-heating/replacing-your-water-heater.

"Homes: Leadership in Energy & Environmental Design." *LEED*, leed.usgbc.org/homes.html.

"Smart Products in Charlottesville." *Albemarle Heating & Air*, 2020, www.albemarleheating.net/products/smart-products/.

"Thermostats." *Energy.gov*, 2019, www.energy.gov/energysaver/thermostats.

Interview

Driscoll, DeWitt. "Positive Energy Consultant, Certified Building Analyst and Home Energy Auditor ." 10 Oct. 2020.

Driscoll, Cecilia. "Positive Energy, Sole Proprietor ." 11 Oct. 2020.

Meetings

Lela from UVA OFS, October 5, 2020.

Dylan Cudahy Works Cited

"About Housing & Residential Life." *Arizona.edu*, The University of Arizona, housing.arizona.edu/about-us.

Breland, Ali. “If the Tuition Doesn't Get You, the Cost of Student Housing Will.” *Bloomberg.com*, Bloomberg, 13 Aug. 2019, www.bloomberg.com/news/features/2019-08-13/if-the-tuition-doesn-t-get-you-the-cost-of-student-housing-will.

“Climate Action & Energy.” *UVA Sustainability*, The University of Virginia, sustainability.virginia.edu/steward/climate-action-energy.

“Colleges Are Clueless about the Cost of off-Campus Housing.” *Business Insider*, Business Insider, 10 Sept. 2015, www.businessinsider.com/cost-of-off-campus-housing-in-college-2015-9.

Doty, Allion, et al. “Off-Campus Housing Sustainability Program.” *Arizona Housing and Residence Life*, The University of Arizona, Jan. 2018, studentlifefees.arizona.edu/storage/ua-green-fund/u6jBZMG5kQ8hjy99HXzhxjxwJR9kDWDbIVgrcNrt.pdf.

“Frequently Asked Questions (FAQs).” *U.S. Energy Information Administration (EIA)*, U.S. Energy Information Administration, www.eia.gov/tools/faqs/faq.php?id=97.

“Greenhouse Gas Equivalencies Calculator.” *EPA*, Environmental Protection Agency, 15 Oct. 2018, www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

“Harvard University Housing.” *Sustainability at Harvard*, Harvard University, green.harvard.edu/schools-units/harvard-university-housing.

“Here's What Student Life Is Like At Harvard University.” *US News and World Report*, US News and World Report, www.usnews.com/best-colleges/harvard-university-2155/student-life.

“How Does University of Arizona Rank Among America's Best Colleges?” *U.S. News & World Report*, U.S. News & World Report, www.usnews.com/best-colleges/university-of-arizona-1083.

“Off-Grounds Housing.” *Housing and Residence Life, U.Va.*, The University of Virginia, housing.virginia.edu/area/1186.

“Projects & Initiatives.” *Office of Sustainability*, The University of Arizona, sustainability.arizona.edu/projects.

“Statistics.” *Statistics | The Office of Undergraduate Admission*, The University of Virginia, admission.virginia.edu/admission/statistics.

"Student Housing Analysis Study." *Office Architect*, The University of Virginia, May 2013, officearchitect.virginia.edu/pdfs/UVAPhase_I_Documentation-BriefingMemo.pdf.

Emma Stovall Works Cited

Reports

"Uncovering Energy Inequity; Executive Summary." Community Climate Collaborative. July 2020.https://static1.squarespace.com/static/5a0c67f5f09ca475c85d7686/t/5f20949c44ed074363b0e4db/1595970717643/C3%27s+Uncovering+Energy+Inequity+-+Executive+Summary.pdf. Accessed 15 Oct. 2020.

"University of Virginia; Student Housing Analysis Study." Brailsford & Dunlavey. May 2013. https://officearchitect.virginia.edu/pdfs/UVAPhase_I_Documentation-BriefingMemo.pdf. Accessed 11 Oct. 2020.

Other Online Resources

A Green City. City of Charlottesville. https://www.charlottesville.gov/698/A-Green-City. Accessed 18 Oct. 2020.

Green Incentives & Rebates. City of Charlottesville. https://www.charlottesville.gov/724/Green-Incentives-Rebates. Accessed 18 Oct. 2020.

Habel, Claire. "Introducing the Housing Voucher and Energy Efficiency Program (VEEP)." *Community Climate Collaborative*, https://theclimatecollaborative.org/news/2019/9/6/introducing-the-housing-voucher-and-energy-efficiency-program-veep. Accessed 18 Oct. 2020.

Moore, Travis. *Dillon Rule and Home Rule: Principles of Local Governance*. https://nebraskalegislature.gov/pdf/reports/research/snapshot_localgov_2020.pdf Accessed 9 Oct. 2020.

Programmable Thermostat Rebate. City of Charlottesville. https://www.charlottesville.gov/618/Programmable-Thermostat-Rebate. Accessed 18 Oct. 2020.

Special Tax Rate for Energy Efficient Buildings. City of Charlottesville. https://www.charlottesville.gov/727/Special-Tax-Rate-for-Energy-Efficient-Bu. Accessed 18 Oct. 2020.

"VEEP." *LEAP: The Local Energy Alliance Program*, https://leap-va.org/veep/. Accessed 18 Oct. 2020.

Vision Statement. City of Charlottesville. https://www.charlottesville.gov/684/Vision-Statement. Accessed 3 Oct. 2020.

Meetings

Lela from UVA OFS, October 5, 2020.
City of Charlottesville Sustainability, October 16, 2020.

Oliver's Sources

Erin Doman on June, et al. "8 Benefits of Programmable Thermostats." *Compact Appliance*, 13 Dec. 2016, learn.compactappliance.com/programmable-thermostats/.

Bradely, Kevin. "Invest in an Energy Efficient Air Conditioner." *Moore Mechanical*, 3 Jan. 2020, mooremechanical.com/blogbenefits-energy-efficient-air-conditioners/.

Chow, Hannah. "Unplugging to Save Energy." *Sustainability for the Common Good*, 27 July 2012, geo300summer.wordpress.com/2012/07/27/unplugging-to-save-energy-2/.

Gov, Energy. "How Energy-Efficient Light Bulbs Compare with Traditional Incandescents." *Energy.gov*, 2019, www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/how-energy-efficient-light.

Gov, Energy. "Thermostats." *Energy.gov*, 2019, https://www.energy.gov/energysaver/thermostats.

"LEED rating system," *U.S. Green Building Council*, https://www.usgbc.org/leed

"Light Bulb Efficiency," *Center for Nanoscale Science - Materials Research Science and Engineering Center*, 2018. Pennsylvania State University. https://www.mrsec.psu.edu/content/light-bulb-efficiency#:~:text=As%20the%20electrons%20move%2C%20they,90%25%20is%20lost%20as%20heat

"Methodology for Estimated Energy Savings from Cost-Effective Air Sealing and Insulating." *About ENERGY STAR | ENERGY STAR*, 2018, www.energystar.gov/campaign/seal_insulate/methodology.

"Replacing Your Water Heater," *Smarter House*, Water Heating - Energy Saving Tips, https://smarterhouse.org/water-heating/replacing-your-water-heater

ProTech. “Benefits of Insulating Exterior Walls.” *ProTech Insulators*, ProTech Insulators ProTech Insulators, 16 Jan. 2017, protechinsulate.com/benefits-insulating-exterior-walls/.

“UVA Building Performance Energy and Water Tracker,” UVA Facilities Management, https://energytracker.fm.virginia.edu/

“Water Conservation.” *The Benefits of Water Conservation Kits*, 2016, www.conservationmart.com/t-benefits-of-water-conservation-kits.aspx.

Generate and Select

Annabelle’s References

Broussand and Floress. “Are Newsletters Effective? Accessing Their Role as a Communication Tool,” Purdue University Cooperative Extension Service, https://www.extension.purdue.edu/extmedia/fnr/fnr-269-w.pdf

Gegenfurtner and Ebner, “Webinars in higher education and professional training: A meta-analysis and systematic review of randomized controlled trials,” November 2019, Educational Research Review, Volume 28

“Home Energy Challenge” https://www.cvillechallenge.org/

Kelly, Jane. “A flipping awesome history of UVA’s wildly successful Pancakes for Parkinson’s.” October 11, 2018. UVA Today.https://news.virginia.edu/content/flippin-awesome-history-uvas-wildly-successful-pancakes-parkinsons

“Majors Newsletter,” Department of Environmental Sciences, UVA Arts and Sciences https://evsc.as.virginia.edu/majors-newsletter

“Off-Grounds Housing Fair,” Housing and Residence Life - Events, University of Virginia, https://housing.virginia.edu/events/2956

“Outreach”, Department of Environmental Sciences, UVA Arts and Sciences https://evsc.as.virginia.edu/outreach

“Resources,” Off-Grounds Housing, University of Virginia, https://offgroundshousing.student.virginia.edu/resource

"Seminars", Department of Environmental Sciences, UVA Arts and Sciences
https://evsc.as.virginia.edu/seminars

Winthrop, Jane. "Fourth Year 5K anticipates highest participation ever," November 15, 2015. The
Cavalier Daily,
https://www.cavalierdaily.com/article/2015/11/fourth-year-5k-looks-forward-to-its-biggest-race-yet

David's Sources

Blum, Philipp, et al. "CO2 Savings of Ground Source Heat Pump Systems – A Regional Analysis." *Renewable Energy*, Pergamon, 3 Aug. 2009, www.sciencedirect.com/science/article/abs/pii/S0960148109003024.

"Carbon and Usage Calculation Methods." *Carbonfund.org*, 28 Oct. 2020, carbonfund.org/calculation-methods/.

"Dominion Energy Virginia – Small Business Improvement Program." *Dominion Energy – Energy Conservation Programs in Virginia and North Carolina*, 19 Aug. 2020, domsavings.com/va/sbi/?gclid=Cj0KCQiAk53-BRD0ARIsAJuNhptzXo9TxC2zNSfU7_ncbRintGkf5qlOEepxmGvZdy31mtWpnUMw3kQaAv_AEALw_wcB.

"Energy- and Cost-Savings Calculators for Energy-Efficient Products." *Energy.gov*, www.energy.gov/eere/femp/energy-and-cost-savings-calculators-energy-efficient-products.

"Energy- and Cost-Savings Calculators for Energy-Efficient Products." *Energy.gov*, www.energy.gov/eere/femp/energy-and-cost-savings-calculators-energy-efficient-products.

Frequently Asked Questions (FAQs) - U.S. Energy Information Administration (EIA), www.eia.gov/tools/faqs/faq.php?id=45.

"Home - LEAP: The Local Energy Alliance Program." *LEAP*, leap-va.org/.

Howard Perlman, USGS, and USGS Scott Young. "Per Capita Water Use: How Much Water Do You Use in Your Home?" *Per Capita Water Use: How Much Water Do You Use at Home? USGS Water Science School*, water.usgs.gov/edu/activity-percapita.php.

"Key Water Heating Charts: Plumbing Perspective." *Plumbing Perspective | News, Product Reviews, Videos, and Resources for Today's Contractors.*, 3 July 2012, plumbingperspective.com/key-water-heating-charts.

"Sacramento Municipal Utility District Heat Pump Water Heater Field Testing Report." *Stud.org*, 16 Jan. 2016, www.smud.org/-/media/Documents/Corporate/About-Us/Reports-and-Documents/2018/HPWH-Field-Testing-Report-1-6-2016.ashx.

"Solar, Wind and Nuclear Have 'Amazingly Low' Carbon Footprints, Study Finds." *Carbon Brief*, 8 Dec. 2017, www.carbonbrief.org/solar-wind-nuclear-amazingly-low-carbon-footprints.

Dylan's Sources

Banister, Craig. "6 Key Components of an Association Website." *Raybourn Group International*, 15 June 2018, raybourn.com/6-key-components-of-an-association-website/.

"Definition of an Association." *Internal Revenue Service*, www.irs.gov/charities-non-profits/definition-of-an-association.

Ibele, Terry. "How to Start an Association Step by Step." *Wild Apricot Blog*, 24 Nov. 2017, www.wildapricot.com/blogs/newsblog/2017/11/24/how-to-start-an-association.

Imani, Faizah. "Key Elements of a Nonprofit Program." *Small Business - Chron.com*, Chron.com, 21 Nov. 2017, smallbusiness.chron.com/key-elements-nonprofit-program-22226.html.

PHAR Cville, 29 Oct. 2020, www.pharcville.org/.

Rominiecki, Joe. "Why Mission Comes Before Membership." *Associations Now*, 18 Dec. 2013, associationsnow.com/2013/12/why-mission-comes-before-membership/.

Ross, Sean. "What Is the Main Business Model for Insurance Companies?" *Investopedia*, Investopedia, 29 Aug. 2020, www.investopedia.com/ask/answers/052015/what-main-business-model-insurance-companies.asp.

Schindlinger, Dottie. "What's the Difference Between an Association and a Nonprofit?: Diligent." *BoardEffect*, 4 Jan. 2019, www.boardeffect.com/blog/whats-difference-association-nonprofit/.

Oliver's References

24, Digital. "How Important Are Customer Reviews for Online Marketing?" *Digital 24*, 7 Mar. 2018, www.digitaltwentyfour.com/important-customer-reviews-online-marketing/.

Carney, Lucy. "How Much Does a Website Cost in 2020? (Full Breakdown)." *Website Builder Expert*, 27 Nov. 2020, www.websitebuilderexpert.com/building-websites/how-much-should-a-website-cost/.

Hive, Thrive. "15 Free Ways to Drive More Traffic to Your Website in 2020." *ThriveHive*, 29 Mar. 2020, thrivehive.com/free-ways-increase-website-traffic/.

Keller, Chris R. "Importance of Website." *Importance of Website: 9 Great Reasons Why You Need One*, 2019, profitworks.ca/blog/297-why-having-a-website-is-important.

Rohnke, Karl. "Section 4. Conducting a Workshop." *Chapter 12. Providing Training and Technical Assistance | Section 4. Conducting a Workshop | Main Section | Community Tool Box*, 2012, ctb.ku.edu/en/table-of-contents/structure/training-and-technical-assistance/workshops/main.

Wood, Laura. "Impact of COVID-19 on the Online Tutoring Industry, 2020 - STEM Courses Gaining Traction Due to Growing Use from Schools and College Students - ResearchAndMarkets.com." *Business Wire*, 1 May 2020, www.businesswire.com/news/home/20200501005299/en/Impact-of-COVID-19-on-the-Online-Tutoring-Industry-2020---STEM-Courses-Gaining-Traction-due-to-Growing-Use-from-Schools-and-College-Students---ResearchAndMarkets.com.

Emma's References:

3 Main Benefits Of Branding With Signage. Founder's Guide. 29 Jan. 2019, https://foundersguide.com/benefits-of-branding-with-signage/.

"About Pearl." *Pearl Certification*, https://pearlcertification.com/about-pearl.

Adams, Gabrielle. "Interpersonal Influence." Foundations of Behavioral Science, 23 September 2019, University of Virginia.

Brookstein, Pamela, and Julie Caracino. *Making the Value Visible:* 2019.

Chou, Eileen. "Influence Tactics: When you are in the majority." 15 September, 2020, Batten School of Leadership and Public Policy.

Thayer, Kate. "Campaign Signs Are Everywhere. But Do They Work?" *Chicagotribune.Com*, https://www.chicagotribune.com/lifestyles/ct-life-election-campaign-signs-20181018-story.html.

Design Concept Exploration

Sustainability Principles Sources

Basiago, "Economic, social, and environmental sustainability in development theory and urban planning practice," *The Environmentalist* 19, 145-161 (1999), https://www.amherst.edu/system/files/media/0972/fulltext.pdf

Community Climate Collaborative, "Uncovering Energy Inequity: an Analysis of How Energy Burden is Distributed in Charlottesville, VA," July 2020

USA Department of Energy, "Why Institute a Low-Income Lens for Energy?," Office of Energy Efficiency and Renewable Energy, https://www.energy.gov/eere/slsc/low-income-community-energy-solutions

The American Council for an Energy Efficient Economy, "How High Are Household Energy Burdens," 2020, https://www.aceee.org/energy-burden

Outreach Sources (Annabelle)

Community Outreach Lessons Learned and Good Practices, *The Ottawa Neighbourhoods Social Capital Forum*, 2016, pg. 1, https://cdfcdc.ca/wp-content/uploads/2015/02/Community-Outreach-Good-Practices.pdf

Dewson S, Davis S, Casebourne J. "Maximising the Role of Outreach in Client Engagement," *Department for Work and Pensions,* Research Report DWPRR 326, March 2006, https://archive.vn/20130420105257/http://www.employment-studies.co.uk/pubs/summary.php?id=dwp326

Forbes Nonprofit Council, "Nine Ways Nonprofits Can Increase Community Engagement," *Forbes,* 17 Oct 2017, https://www.forbes.com/sites/forbesnonprofitcouncil/2017/10/17/nine-ways-nonprofits-can-increase-community-engagement/?sh=215980387799

"Identifying Prospective Donors and Crafting Tailored Materials," Spitfire Strategies, n.d.,

https://www.communitycatalyst.org/resources/toolkits/CVC-Local-Donor-and-Funder-Outreach-Toolkit.pdf

Marketing Sources (Luca):

Barnhart, Brent. "Building Your Social Media Marketing Strategy for 2021." *Sprout Social*, Sprout Social, Inc., 2 Mar. 2021, sproutsocial.com/insights/social-media-marketing-strategy/.

Gordon, Ross, et al. "A Framework for Sustainable Marketing." *Marketing Theory*, vol. 11, no. 2, 2011, pp. 143–163., doi:10.1177/1470593111403218.

Newberry, Christina, and Evan LePage. "How to Create a Social Media Strategy in 8 Easy Steps (Free Template)." *Social Media Marketing & Management Dashboard*, Hootsuite, 9 Nov. 2020, blog.hootsuite.com/how-to-create-a-social-media-marketing-plan/.

Seretny, Marek & Seretny, Aleksandra. (2012). Sustainable Marketing - A New Era in the Responsible Marketing Development. Foundations of Management. 4. 10.2478/fman-2013-0011.

Trivedi, Krunal, et al. "Sustainable Marketing Strategies: Creating Business Value by Meeting Customer Expectation." *International Journal of Management, Economics and Social Sciences*, vol. 7, no. 2, 2018, pp. 186–205.

"Ultimate Guide to Sustainable Marketing." *Yodelpop Marketing*, Yodelpop, Inc., 2021, www.yodelpop.com/ultimate-guide-to-sustainable-marketing#strategy.

Nonprofit Sources (Bryce):

"About Student Organizations at UVA." *About Student Organizations at UVA | Student Engagement, UVA*, studentengagement.virginia.edu/about-student-organizations-uva.

Compliance, Harbor. "Information Center." *How to Start a Nonprofit Organization in Virginia | Harbor Compliance*, www.harborcompliance.com/information/how-to-start-a-non-profit-organization-in-virginia.

"Gift Grant." *UVA Sustainability*, sustainability.virginia.edu/resources/gift-grant.

"Grants & Funding." *UVA Sustainability*, sustainability.virginia.edu/engage/get-involved/grants-funding.

"Nonprofit Org Chart: Definition & Key Points." *Org Charting*, www.orgcharting.com/nonprofit-org-chart/.

Price, Nick. "Why a Nonprofit Is Different Than an Association." *BoardEffect*, 4 Jan. 2019, www.boardeffect.com/blog/why-nonprofit-different-association/.

Environmental Impact and Data Management Sources (Dylan):

A. Alsalemi *et al*., "Boosting Domestic Energy Efficiency Through Accurate Consumption
Data Collection," *2019 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computing, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovation (SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI)*, Leicester, UK, 2019, pp. 1468-1472, doi: 10.1109/SmartWorld-UIC-ATC-SCALCOM-IOP-SCI.2019.00265

Brailsford, & Dunlavey. (2013, May). Student Housing Analysis Survey. Retrieved

October 16, 2020, from

https://officearchitect.virginia.edu/pdfs/UVAPhase_I_Documentation-BriefingMemo.

pdf

Luca Marketing Sources

Barnhart, Brent. “Building Your Social Media Marketing Strategy for 2021.” *Sprout Social*, Sprout Social, Inc., 2 Mar. 2021, sproutsocial.com/insights/social-media-marketing-strategy/.

Gordon, Ross, et al. “A Framework for Sustainable Marketing.” *Marketing Theory*, vol. 11, no. 2, 2011, pp. 143–163., doi:10.1177/1470593111403218.

Newberry, Christina, and Evan LePage. “How to Create a Social Media Strategy in 8 Easy Steps (Free Template).” *Social Media Marketing & Management Dashboard*, Hootsuite, 9 Nov. 2020, blog.hootsuite.com/how-to-create-a-social-media-marketing-plan/.

Seretny, Marek & Seretny, Aleksandra. (2012). Sustainable Marketing - A New Era in the Responsible Marketing Development. Foundations of Management. 4. 10.2478/fman-2013-0011.

Trivedi, Krunal, et al. “Sustainable Marketing Strategies: Creating Business Value by Meeting Customer Expectation.” *International Journal of Management, Economics and Social Sciences*, vol. 7, no. 2, 2018, pp. 186–205.

“Ultimate Guide to Sustainable Marketing.” *Yodelpop Marketing*, Yodelpop, Inc., 2021, www.yodelpop.com/ultimate-guide-to-sustainable-marketing#strategy.

Appendix

Appendix A: **Luca's LEAP Energy Audit, March 31st** (3 pages)

leap
local energy alliance program

March 31, 2021

Luca Pfeiffer
1513 Virginia Ave
Apt 2
Charlottesville, VA 22903

Building Information

Conditioned Area: 1148
Number of Occupants: 4
Foundation Type: ---
Bathroom(s): 2

Year Built: 1986
Bedroom(s): 4
Stories Above Grade: ---
Area Above Grade: ---

HEATING SYSTEM
Type: Heat Pump
Fuel: Electricity

COOLING SYSTEM
Type: Heat Pump

WATER HEATING SYSTEM
Type: Storage
Size: 50 gal
Fuel: Electricity
Age: 2016

Blower Door Results: 1161

leap
local energy alliance program

Recommendations

Air Sealing

- Caulk gaps at interior trim, where trim meets wall/floor/ceiling and where trim meets trim
- Caulk or spray foam electrical and plumbing gaps in kitchen cabinets and under appliances
- Remove duct registers and inspect for gaps where the metal duct boot is not sealed to the drywall or flooring. Seal with mastic or tape.
- Lock windows to engage weatherstripping

Exhaust Fans

- Install new, high airflow fans for the bathroom, along with a smart switch for one of the bathrooms which will allow the fan to run for 48 minutes every hour. This will ensure compliance with ASHRAE standards for ventilation based on the apartment's size and leakage.
- Vent the bathroom exhaust fan to exterior with dampered enclosure, with shortest length of 4" insulated hard pipe duct or 4" insulated flex duct

Water Heater

- Add a water heater blanket
- Add pipe insulation where accessible
- Extend pressure relief valve to within 6 inches of the floor
- Set the water heater to 120 degrees (safe for children & saves energy)

Light Bulb Replacement

- Replace any incandescent bulbs with high efficiency, LED bulbs

Contractors Used by LEAP

- HVAC and Water Heater
  - A&J Heating and Air
    - Keith Nordstrom
    - 434-465-5992
    - ajheatingair@gmail.com
  - Fitch Services
    - 434-296-9980
- Insulation
  - Weatherseal
    - 434-974-1818
    - https://www.weathersealinsulation.com/contact-us
  - Creative Conservation

Local Energy Alliance Program, Inc. (LEAP)
608 Ridge Street · Charlottesville, VA 22902
(434)-227-4666 · info@leap-va.org
www.leap-va.org

- 434-878-3227
- sales@creativeconservation.com
- https://www.creativeconservation.com/contact-us/charlottesville

Appendix B: **UVA Equity and Environment Fund grant application** (2 pages)

How does the project confront the intersection of equity and sustainability? *

Please elaborate on both how the project attends to inclusion and collaboration in its process (e.g. by centering community perspectives and inputs) and how it addresses issues of equity and sustainability in its intended impact.

This project confronts the intersection of equity and sustainability by removing financial barriers to sustainable action that students face, and working to address all three pillars of sustainability (economic, environmental, and social).

* We believe sustainable living should not be reserved for those with financial privilege or education surrounding sustainability, but for all college students.

* We will equitably provide access to energy efficiency resources, which often have a high upfront cost and payback periods that exceed a student's lease in a college apartment.

* We will educate and empower students to work with landlords where needed for larger improvements.

* UVA's carbon neutrality goals do not include off-Grounds housing, but UVA students living in the Charlottesville community contribute a carbon footprint to the Charlottesville community. Making off-Grounds housing "greener" will reduce the emissions of UVA students within Charlottesville.

The UVA Greener Housing Coalition is starting with a project based around energy efficiency -- a key area within the environmental justice movement.

* Lower-income households pay disproportionate levels of their income on energy (according to the USA Department of Energy, Office of Energy Efficiency and Renewable Energy). This is true in our local community (see the Community Climate Collaborative report "Uncovering Energy Inequity: an Analysis of How Energy Burden is Distributed in Charlottesville, VA"). Black, Hispanic, and Native American households face greater-than-average burdens (see the American Council for an Energy Efficient Economy's report "How High Are Household Energy Burdens?").

* While UVA pursues sustainable housing for students who stay on Grounds, the majority of students live in off-Grounds housing. Within the literature on energy burdens, there is a gap in research on students-specific situations. In addition to the aforementioned barriers for sustainable housing improvement, students off-Grounds also pay utility bills, which are often undisclosed beforehand and range in price.

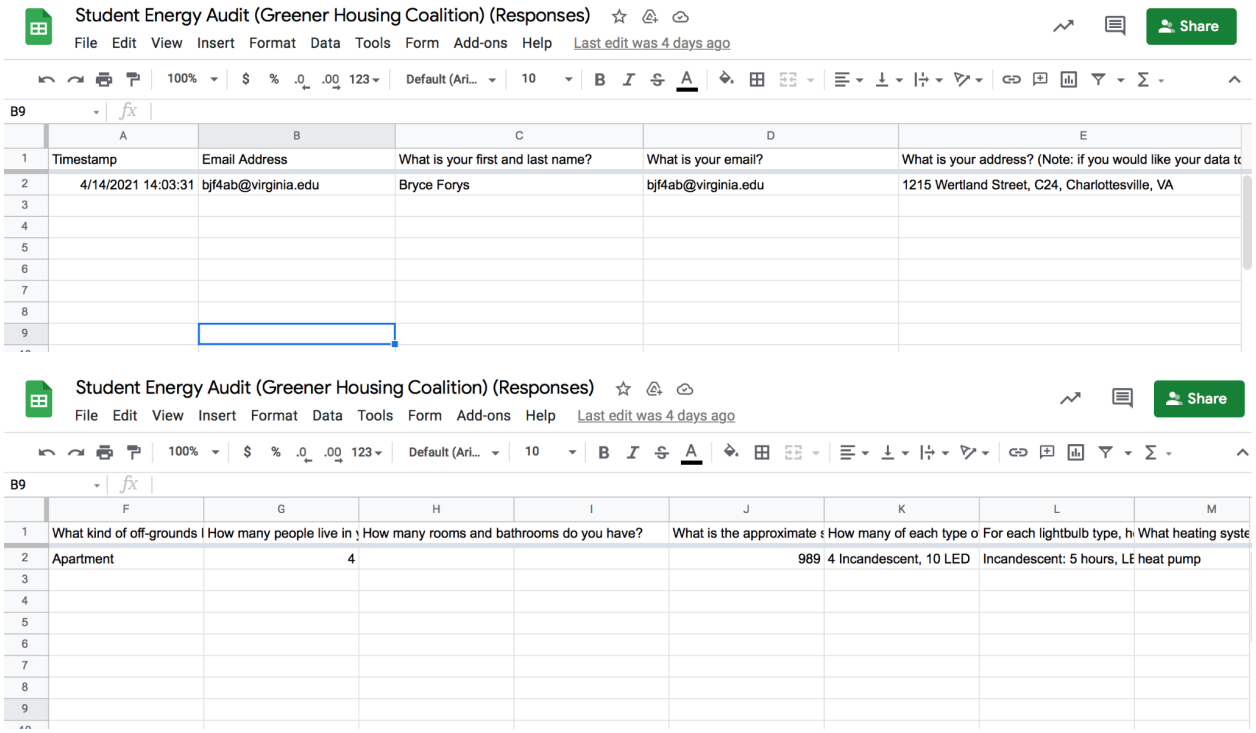
* We will prioritize outreach to students who are from low-income backgrounds and whose utility payments may cause a more significant energy burden. For example, targeting outreach through specific newsletters, such as the Dean of Students' "First Generation Low Income Student Support" (source: https://access.odos.virginia.edu/).
While making off-Grounds housing "greener," we will educate our peers on the tools and methods for living sustainably wherever they move next, reducing their future energy costs and emissions.

Our organization will work for social sustainability, in addition to environmental sustainability.

* We define "social sustainability" as integrating equity and justice within our efforts to pursue other areas of sustainability.

* We will address this ensuring our board of directors is diverse and that we are targeting student groups that may have less access to energy efficiency and sustainability resources. In addition, we believe in providing meaningful opportunities that are paid where possible.

Appendix C: **Data Management Collection Example** (Google Sheets)



Student Energy Audit (Greener Housing Coalition) (Responses)

File Edit View Insert Format Data Tools Form Add-ons Help Last edit was 4 days ago

Share

B9

	A	B	C	D	E
1	Timestamp	Email Address	What is your first and last name?	What is your email?	What is your address? (Note: if you would like your data to
2	4/14/2021 14:03:31	bjf4ab@virginia.edu	Bryce Forys	bjf4ab@virginia.edu	1215 Wertland Street, C24, Charlottesville, VA
3					
4					
5					
6					
7					
8					
9					

Student Energy Audit (Greener Housing Coalition) (Responses)

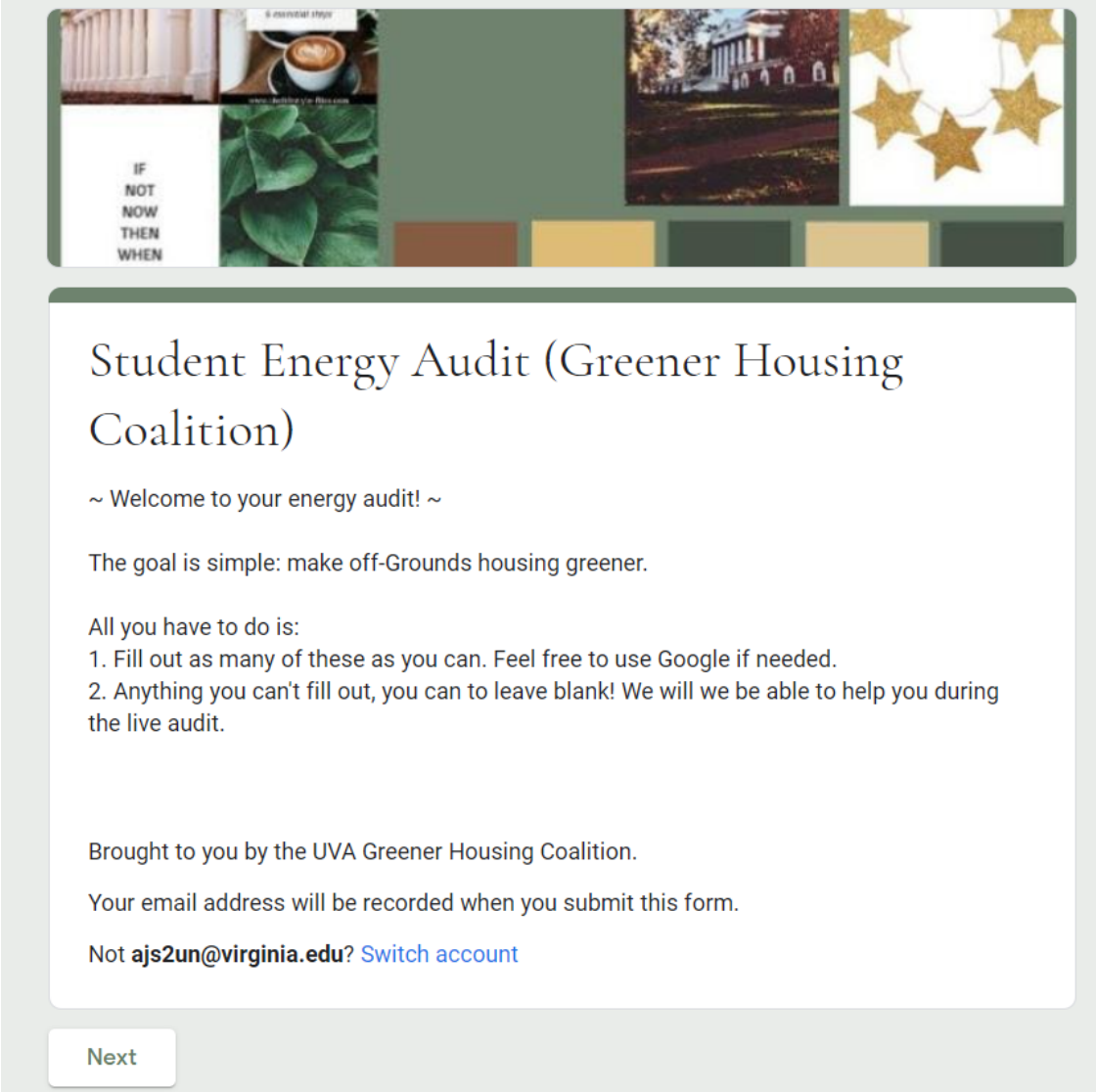
File Edit View Insert Format Data Tools Form Add-ons Help Last edit was 4 days ago

Share

B9

	F	G	H	I	J	K	L	M
1	What kind of off-grounds l	How many people live in y	How many rooms and bathrooms do you have?		What is the approximate s	How many of each type o	For each lightbulb type, h	What heating syste
2	Apartment	4			989	4 Incandescent, 10 LED	Incandescent: 5 hours, LE	heat pump
3								
4								
5								
6								
7								
8								
9								

Appendix D: **Energy Audit Google Form** (7 pages)



Basic Information

Note: This will only be used by the Greener Housing Coalition and on our honor, individual data will not be shared under any circumstances.

What is your first and last name? *

Your answer

What is your email? *

Your answer

What is your address? (Note: if you would like your data to be anonymized and your address separated from the data, please just say "Confidential" after the address.) *

Your answer

Housing Info

What kind of off-grounds housing do you live in?

- ◯ House
- ◯ Apartment
- ◯ Other: _____

How many people live in your house/apartment? (including you)

Your answer

How many rooms and bathrooms do you have?

Your answer

◯ Option 1

What is the approximate square footage of your house/apartment?

Your answer

Back Next

Lighting

You can use this link for help identifying lighting: https://medium.com/@omegapacific/5-different-types-of-light-bulbs-32472c24bb70

How many of each type of lightbulb do you have? (i.e Incandescent 5, Fluorescent 0, Compact Fluorescent 2, Halogen 0, LED 3)

Your answer

For each lightbulb type, how many combined hours per day do you have the lights on? (i.e. Fluorescent 3 hours, LED 0.5 hours...)

Your answer

Back Next

AC + Heat

Use this link for help identifying heating systems: https://smarterhouse.org/heating-systems/types-heating-systems

What heating system do you have? (i.e., is it natural gas-based, radiators, heat pump, furnace, boilers)

Your answer

What is your AC unit model:

Your answer

During the appropriate seasons, how often do you use your heat and AC?

	Up to 2 hours	2 to 4 hours	4 to 6 hours	Over 8 hours	Always running
Heat	☐	☐	☐	☐	☐
AC	☐	☐	☐	☐	☐

What kind of water heater do you have?

- ◯ Electric
- ◯ Gas
- ◯ Other: _____

Does your water heater have a insulation blanket?

- ◯ Yes
- ◯ No
- ◯ Other: _____

Back Next

Finally, some non-energy questions!

Do you compost?

- ◯ Yes, all the time
- ◯ Yes, but just some of my food
- ◯ No

If you answered "No" to the composting question, why not?

Your answer

How do you recycle?

- ◯ My housing has accessible recycling
- ◯ I drive to an external recycling plant
- ◯ I don't recycle
- ◯ Other:

If you don't currently recycle, why not?

Your answer

Thank you for your time!!