Opportunities and Benefits of a University-Based Weatherization Assistance Program: The Case of Furman University's Community Conservation Corps

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Abstract

Weatherization assistance programs have been in existence in the United States for decades, but they are commonly managed and implemented by local government organizations. Furman University, a small liberal arts college, occupies a unique position as an institution of higher education that runs a weatherization program through its sustainability center. In this article we present a case report on Furman's Community Conservation Corps (CCC), which has been weatherizing low-income households in Greenville, South Carolina, for nearly a decade. We provide background on weatherization assistance programs, the history of Furman's CCC, nine years of energy-use data for all weatherized homes, and additional program outcomes. We conclude with recommendations for initiating and scaling weatherization assistance programs within the higher education context.

Keywords: carbon offsets; community engagement; weatherization assistance

Introduction

Weatherization Assistance Programs (WAPs) have been in existence in the United States for decades, with the U.S. Department of Energy officializing a federal program in 1976.[1] While ubiquitous in the public sector, one is less likely to encounter a WAP coordinated through a higher education institution. This case report provides an overview of Furman University's Community Conservation Corps (CCC), a WAP managed by the university's David E. Shi Center for Sustainability, which connects weatherization assistance in low-income communities in Greenville, South Carolina, with university academics and administration, student learning, and volunteer experiences. This article provides a background on WAPs and their potential relationship to college and university goals, describes a case study of Furman's CCC, presents and discusses program outcomes, and concludes with recommendations to other higher education institutions that might consider integrating weatherization assistance into their own program offerings.

Background on Weatherization Assistance Programs

Weatherization assistance became an official program of the U.S. federal government in 1976, when Congress passed the Energy Conservation Policy Act in response to the nearly quadrupled energy prices resulting from the 1973 Oil Crisis. Over the ensuing decades, Department of Energy (DOE) funds have been distributed to each state, supporting home energy efficiency retrofits across the country.[1] The DOE supports local weatherization agencies, local governments, and nonprofit organizations through grants and technical guidance to measure qualifying low-income homes' energy performance, to retrofit these homes to maximize their energy efficiency, and to track the homes' energy performance over time.[2,3] These programs have evolved from offering simple air-sealing measures to conducting a "whole-home"

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analysis with pre- and post-audits to check progress and installation of higher level measures like attic insulation, duct work, and HVAC systems. Currently, the DOE programs serve around 35,000 homes per year, spend an average of $4,695 per home on weatherization measures, and save the average household $283 in annual energy costs.[4]

In addition to cost savings from reduced energy use, weatherization assistance has a number of purported benefits, including improved health and work productivity of home occupants, increased safety of homes, and improved well-being in other areas of the lives of the occupants, among others.[3] All of these benefits are accrued through weatherization strategies that cover home mechanical systems, building shells, electric and water fixtures and appliances, health and safety measures, and resident education. Government-funded WAPs typically conduct weatherizations through staff of partner agencies and private contractors.[4] Also, weatherization is often conducted through community action agencies, which may provide additional social services needed by residents.

While there are examples of higher education institutions engaging directly with weatherizing residences in their communities, most focus on training energy-efficiency professionals,[5] providing program evaluation research,[6,7] or partnering with existing programs that are run by community organizations.[8,9] Furthermore, there are examples of universities engaging with the community around other sustainability issues.[10] Portland State University's Community Environmental Services program provides an analog focused on waste management, connecting students and university resources to community waste management challenges.[11]

It is not surprising that many examples of the intersection of weatherizations and academia focus on education and research, given the traditional role of colleges and universities, though programs like those at Portland State demonstrate the potential for deeper university engagement in the community. Such engagement through weatherization assistance can align with multiple sustainability-related interests of higher education. For instance, managing WAPs presents an avenue for community engagement and service learning,[10] as well as creating opportunities for claiming carbon offsets for universities' presidents' climate commitments to achieve zero-carbon emission goals.[12] For these reasons, Furman University initiated its Community Conservation Corps in 2009.

Case Study: Furman University's Community Conservation Corps

Institutional Overview

Furman University is a four-year private liberal arts college located in Greenville, South Carolina, with an enrollment of nearly 2,700 students. Established in 1826, Furman has a long history of engagement with its surrounding community.[13] Demonstrating a commitment to sustainability, Furman created the David E. Shi Center for Sustainability in 2008. As an academic center, the Shi Center serves to integrate sustainability across the curriculum and engage in sustainability both in campus operations and within the surrounding community. As an animating hub for educators, students, and community leaders, the Shi Center manages multiple signature programs, including: a faculty affiliate program that engages 60 to 70 Furman faculty annually; a faculty fellows program that funds interdisciplinary scholarship; a student fellows program that supports student internships on campus and in the community; campus sustainability assessment; a residential life sustainability peer education program; the academic component of an intentional living community; the Furman Farm; and the Community Conservation Corps (CCC).

Soon after the creation of the Shi Center, staff and committed Furman faculty drafted a campus sustainability master plan. In 2009, the Board of Trustees passed Sustainable Furman, which outlines a long-term approach for establishing the practices, policies, and environment that are necessary for making the university more sustainable. Through this process, Furman leadership committed to carbon neutrality by 2026, the university's bicentennial year.[14]

Community Conservation Corps

Of the programs managed through the Shi Center, the Community Conservation Corps (CCC) is one of the most visible in the Greenville community. In conjunction with the climate action plan, the CCC was founded in 2009, and it performed its first weatherization in 2010. The CCC provides free home weatherization services to low income homeowners in the greater Greenville area, and aims to reduce energy consumption, promote financial stability, and increase environmental awareness of homeowners.

The Community Conservation Corps is primarily managed by a program coordinator, who is assisted by a student fellow during the academic

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year. The weatherizations are conducted through collaboration among the Shi Center, Habitat for Humanity, other Furman entities, and community volunteers. Additionally, the CCC partners with local energy utilities: Piedmont Natural Gas (PNG) and Duke Energy. PNG is the primary program funder, providing grant support to weatherize homes of low-income PNG customers. Funds are directed toward traditional home weatherization tasks as well as investments in mechanical systems for homeowners who have unsafe or inoperable HVAC systems. The utility companies also provide homeowner energy data for pre- and post-weatherization energy use analysis.

In order to qualify for the CCC's weatherization assistance, the homeowner must: own and reside in their home, live in (or close to) Greenville County, have homeowner's insurance, be a Piedmont Natural Gas customer (for priority funding), and have a household income at or below 80 percent of the Area Median Income (AMI) for Greenville County. This imposes a programmatic limitation on Furman's CCC compared to federal WAPS, which are able to also service rental units, multifamily buildings, and mobile homes.

The most common weatherization measures implemented through the CCC include replacing inefficient light bulbs with LEDs, installing smoke detectors and carbon monoxide detectors, blower door directed air sealing with caulking and spray foam, and sealing ductwork connections with mastic. Other measures, like blowing attic insulation, installing a vapor barrier, and adding a water heater blanket are pursued depending on individual homes' needs. The program tries to avoid large expenditures that would reduce the number of homes that can be weatherized in one grant cycle. However, when unsafe situations are discovered (e.g., a cracked heat exchanger in the furnace allowing carbon monoxide to leak into the house), the program has made exceptions and installed large items like new HVAC systems.

The program has at times had to defer weatherization if the discovered damage would interfere with weatherization results or produce hazards. For instance, a leaking roof would ruin new attic insulation. Also, the presence of mold presents health hazards to employees and volunteers. Significant repair needs can exceed the CCC's project budget, but partnering with Habitat for Humanity creates additional avenues for funding extensive home repairs.

The CCC uses a computer-based auditing tool called REM/Design, and a third-party auditor performs pre- and post-audits to determine what work needs to be done and whether the completed work was done correctly. The auditors are all third-party certified.

Unlike a community action agency, this university-based weatherization program does not have the capacity to provide additional social services to residents. However, CCC staff are involved in conversations with homeowners about needs beyond weatherization and provide a list of community partners that are able to offer additional services.

Program Outcomes

Over the first nine years, the CCC weatherized 138 homes and generated an array of benefits spanning home climate impact, student learning, and community building, among others. The following sections discuss four specific program outcomes: 1.) home energy savings, 2.) carbon offsets captured by Furman, 3.) volunteer engagement and student learning, and 4.) community building.

Outcome 1: Home Energy Savings

Table 1 provides an overview of the program's more direct outcomes, showing annually the number of homes weatherized and the associated energy and cost savings. The number of homes varies each year based on the amount of funding available and average cost per home. The Area Median Income (AMI) levels are based on the Housing and Urban Development guidelines,[15] are updated annually, and are location and household-size dependent. Table 1 shows that most of the homeowners fall below the 40 percent AMI level, even though the program accepts incomes up to 80 percent AMI.

Energy savings are gathered directly from the homeowners' energy bills that are provided to the program by the energy company. The energy and monetary savings vary throughout the years because different measures are taken on each house. For example, one house may have received attic insulation, while another house might have been unable to receive insulation because of a roof leak. The CCC tracks electrical and gas savings, while some programs only track electrical. Even so, energy and monetary savings are comparable to other programs.[7,16]

The monetary savings are one of the most important aspects of the program to the homeowners. Pre-weatherization, some households were receiving $300 to $400 monthly energy bills for modest-sized homes (1,000 to 1,400 sq. ft.). For many of the households the CCC serves, the

Table 1. CCC Weatherization Program Data

Year	Number of Homes Weatherized	Median Household Income (% of AMI)	Electric Savings / Home (kWh)	Natural Gas Savings / Home (therms)	Annual Energy Cost Savings / Home
2010-11	14	< 40%	2,719	167	$544
2011-12	16	40–60%	1,339	110	$328
2012-13	18	< 40%	925	66	$204
2013-14	17	< 40%	475	99	$206
2014-15	17	< 40%	842	129	$309
2015-16	15	40–60%	1,445	166	$420
2016-17	14	< 40%	729	47	$157
2017-18	16	< 40%	N/A	N/A	$186*
2018-19	12	< 40%	N/A	N/A	$247*

* Numbers are estimates from auditor's analysis using REM/Design programming.
N/A identifies values for which data is not yet available.

combination of home and energy costs have exceeded 30 percent of household income, making their housing unaffordable. Reducing annual household energy costs allows families to reallocate funds to other necessities.

Outcome 2: Carbon Offsets Captured by Furman

The CCC presents an opportunity for "purchasing/earning carbon offsets," one of Furman's five broad emissions reduction strategies outlined in its sustainability master plan.[14] Claiming carbon offsets, in general, has the potential to reduce Furman's total greenhouse gas emissions by 12 percent from its 2009 baseline of 33,777 $MTCO_2e$, and the avoided emissions from weatherized homes is one avenue for Furman to achieve this. Annually, the CCC contributes roughly 90 $MTCO_2e$ (Table 2) to Furman's total offsets, which only accounted for a 0.27 percent reduction in 2009. Furman's 2018 reported gross emissions were 20,309 $MTCO_2e$, and the CCC contributed 0.50 percent toward reducing these emissions.[17] These offset emissions are equivalent to the emissions from roughly 19 passenger vehicles driven for one year, emissions avoided by 31.4 tons of waste recycled instead of landfilled, or carbon sequestered by 118 acres of U.S. forests in one year.[18]

Table 2 shows the annual avoided emissions that Furman claims as carbon offsets. The carbon equivalents

Table 2. Annual CO_2e Offsets Derived from CCC-Weatherized Homes

Year	Number of Homes Weatherized	Electric Savings/ Home (kWh)	Natural Gas Savings/ Home (therms)	Avoided emissions ($MTCO_2e$)	Captured Offsets ($MTCO_2e$)
2010-11	14	2,719	167	32.5	32.5
2011-12	16	1,339	110	24.1	56.6
2012-13	18	925	66	17.7	74.3
2013-14	17	475	99	14.2	88.5
2014-15	17	842	129	21.4	109.9
2015-16	15	1,445	166	28.2	105.6
2016-17	14	729	47	9.4	90.9
2017-18	16	N/A	N/A	12.9*	86.1*
2018-19	12	N/A	N/A	13.2*	85.1*

*Numbers are estimates from auditor's analysis using REM/Design programming.
N/A identifies values for which data is not yet available.

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of the avoided emissions are calculated with emissions factors provided by the EPA. Each kWh equals 0.000707 $MTCO_2e$, and each therm equals 0.0053 $MTCO_2e$.[19] Avoided emissions are reported for the year directly after the weatherization. Offsets are claimed for each home's avoided emissions for up to five years post-weatherization, at which point the integrity of the improvements can no longer be guaranteed. The five-year window for counting the offsets is based on an institutional policy by the university, which is currently exploring data collection options to assess the viability of these offsets for longer periods of time. These offsets are not presently verified by a third-party audit, but they are reported with the university's annual GHG inventory and accepted by Second Nature.[17]

Considering this data, the program has a very small impact on reducing the university's carbon emissions. In order to make a substantial impact, the program would need to be scaled up significantly. To compensate for 12 percent of Furman's gross emissions from 2018, the program would have to offset 2,438 $MTCO_2e$ per year, scaling up the program by more than 27 times its current rate. This equates to weatherizing around 406 homes per year, which would require a significant increase in funding, volunteers, and labor.

Outcome 3: Volunteer Engagement and Student Learning

While there is reliable data for tracking weatherizations, resulting energy use and costs, and avoided emissions, there are additional outcomes of interest for which sufficient data has not yet been collected. For instance, we have observed firsthand volunteer and student engagement through CCC activities, but at this point can only provide anecdotal accounts of these benefits.

Table 3 details the number of volunteers that have served the CCC and its homeowners each year. Toward the beginning of the program, private contractors were occasionally employed to complete the work, so even though there was sufficient volunteer turnout, the volunteers were not always necessary. However, due to private contractors charging market rates, the cost per weatherization was excessive. Habitat for Humanity of Greenville County became the program's sole contractor in 2014. Habitat for Humanity engages volunteer labor through an array of community groups and individuals. While Habitat for Humanity often requires homeowners to assist in building projects, the CCC does not require physical participation by the homeowner in the weatherization. As such, the program is completely free to the homeowner, though many homeowners choose to help with the weatherization because they enjoy the experience.

It should be noted that volunteer training requires careful attention because the work involved in home weatherization can at times require technical ability that not all volunteers possess. For instance, federal WAPs include closely monitored training and certification requirements, and those conducting federally-funded WAPs are highly trained. Habitat for Humanity employees receive professional training, and Furman volunteers are trained on campus by CCC staff and are closely supervised. Furthermore, licensed contractors are used when jobs require specific expertise that volunteers do not have. Therefore, care is taken in the types of tasks that are assigned to volunteers, recognizing the projects that require professional contractors to complete.

A wide variety of student groups also volunteer each year including: Furman's athletic teams, Alpha Phi Omega (APO) service fraternity, the Environmental Action Group (EAG), academic classes with service learning experiences, Residence Life, Shi Center student fellows, and the Shucker Leadership Institute. The students associated with the Shucker Leadership Institute have the most in-depth volunteer experience. They work on projects to assist the CCC with its processes for an entire academic year and present their reflections at the end. While student learning from

Table 3. Weatherization Volunteers Per Year

Year	Number of Volunteers	Volunteer Hours	Number of Furman Student Volunteers
2010-11	90	N/A	N/A
2011-12	71	N/A	N/A
2012-13	54	N/A	11
2013-14	48	230	20
2014-15	30	188	6
2015-16	94	536	8
2016-17	87	625	15
2017-18	68	488	25
2018-19	63	356	17

these volunteer experiences has not been assessed, based on other research,[20] it is likely that student learning would be stronger when student volunteers engage through an academic course and when the volunteer experience ties into classroom learning outcomes. This point poses opportunities for rich research in the future and might enable Furman faculty who study the science of teaching and learning as well as sustainability education to assess the CCC's programs as applied sustainability learning initiatives.

The Shi Center's student fellowship program funds one student per year to work in-depth with the CCC and program coordinator, providing an opportunity for learning through co-curricular experiences. Since the program's inception, the Shi Center has funded nine Furman student fellows to work with the CCC, six during academic years and three during summers. The CCC student fellow attends pre-audits, home weatherizations, and post-audits with the CCC program coordinator. They analyze and evaluate the pre- and post-weatherization energy and monetary data and calculate the CO_2 emissions avoided to determine the effectiveness of the weatherizations. Through this program the fellow has the opportunity to engage with student volunteers, community members, and program partners.

Outcome 4: Community Building

Beyond student learning, we have observed the CCC creating meaningful connections with the community members it serves. Though no formal data has been collected related to these relationships, anecdotal evidence demonstrates the impact the CCC has had on participating community members. Program participants have noted tangible benefits, including improved thermal comfort in their homes, lower utility bills, improved safety, and the quality of new appliances. They have expressed a general sense of appreciation for the level of attention and care that staff and volunteers commit in each home they service. Multiple residents have noted the feeling of community and strength of relationships that have been built. Furthermore, one individual was so touched that they named the CCC as the sole beneficiary in their will.

The positive impact of the program has improved relationships between groups like students and homeowners, the university and communities, and even between neighbors. Students who volunteer with the program not only learn technical skills, but also get to interact with the homeowners. Many times, they are amazed or humbled by the stories they hear from the homeowner, and the residents enjoy sharing life experiences with younger generations.

Instead of being wary, residents embrace the presence of this university program. The CCC is more commonly known as the "Furman energy efficiency program," which creates a positive perception of the university. The relationships between the participants and their neighbors have also improved because of this program. Neighbors stop by during the weatherization to inquire about the program; its most successful advertising occurs through word-of-mouth by neighbors.

We recognize that at this point we are relying on anecdotal evidence and may make ourselves vulnerable to confirmation bias. For future research, we intend to conduct a full sustainability assessment of the program, based on a logic model and program evaluation framework.[21] As for studying student learning outcomes, the CCC demonstrates how a university-based WAP can create opportunities for future research that are tangentially connected to weatherization assistance, creating exciting new lines of inquiry.

Just as conventional WAPs have traditionally enjoyed good standing in their communities, the CCC works closely with community members, volunteers, and homeowners to repair and retrofit the residents' homes to be more energy efficient and build strong relationships. Since the CCC program is oriented around volunteering and community building, it has the potential to cultivate positive community relationships between the university, community partners, and residents.

Conclusions and Recommendations

A home weatherization program within a higher education institution (particularly a small liberal arts college) may be novel, but such an arrangement allows for a broad set of program outcomes. For instance, Furman University's Community Conservation Corps creates the potential to realize additional benefits beyond monetary and energy savings, including student learning, community building, and research.

To maximize these benefits, particularly with an eye to capturing carbon offsets to help meet the university's carbon commitment, such a weatherization assistance program would need to be scaled up dramatically. Key impediments might include university staffing, volunteer capacity, availability of grant dollars, and recruiting homeowners. To offset a mere 12 percent of Furman's emissions, the

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CCC would need to weatherize over 400 homes per year. In comparison, many government-funded programs do not reach 400 weatherized homes per year, and these programs often have greater funding and staffing than many universities are capable of providing.

Focusing on the number of homes served instead of the quality of service or student outcomes might negate the novelty of a weatherization program associated with a university. However, there is great potential for higher education institutions to have significant positive social, economic, and ecological impacts while pursuing their missions of student learning, scholarship, and community engagement.

Colleges and universities interested in creating weatherization assistance programs may want to consider the following recommendations:

- Start small. Even though a larger number of homes contributes more to carbon offsets and other benefits, starting with one home weatherization as a class project can help create the foundation needed for future success. Furthermore, growing slowly might better create a space for emphasizing student learning and building trust and relationships with broader communities.
- Build trust with homeowners. In the beginning the CCC had to overcome homeowners' assumption that there was a catch to the program. After a campaign to reach out and inform trusted community leaders (pastors, neighborhood associations, etc.), these individuals spread the word about the integrity of the program.
- Partner with local nonprofits, energy companies, and government agencies. Without the CCC's partnership with Habitat for Humanity, the price per weatherization would be close to double, hindering the program from assisting as many homeowners. The local energy provider is the major funder of the program, with supplemental funding from local government. It is also meaningful to align university and funder/contractor missions as much as possible.
- Consider your priorities. If the only reason your university is interested in a weatherization program is to claim carbon offsets, reconsider your strategy. The program may contribute only a small amount to a carbon neutrality goal, and there may be more efficient and cost-effective means for acquiring carbon offsets. Conversely, it might be more fruitful to focus on co-benefits, including the interactions between the university and community as well as student learning, among other outcomes.

A university-based weatherization assistance program can have great potential for benefiting both the university and community, but higher education institutions should be clear about their goals when initiating such programs. For instance, traditional WAPs have provided strong services for decades, and the goal of the university should not be to replace this model, but rather to learn from and support WAPs while driving additional positive outcomes that align with university goals and values.

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