UVA Decarbonization-Plus Academy 2023:
Synthesis Report and Summary of Key Outcomes

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0. Executive Summary

UVA's Decarbonization Academy was slightly retooled and relaunched as the Decarbonization-Plus Academy ("DA+") for its second offering in Summer 2023. The name change reflects a broadening of focus to include not only UVA's carbon goals for 2030 and 2050, but also its pledge to reduce nitrogen emissions by 30% by 2030. The broadening of scope afforded a good opportunity to engage new faculty mentors as well as students with diverse interests compared to 2022, which had been predominantly STEM-focused.

Fifteen UVA students, a mix of undergraduate and graduate students, worked on six projects via DA+ 2023. Two projects were undertaken in direct continuation of projects initiated via DA 2022, namely, **nature-based solutions** and buildings decarbonization ("**smart labs"**). The continued strong success of these projects has made it such that both will progress to implementation phase during the coming academic year (2022-2023). Four new project topics included: a phenology at **Morven Farm**; community outreach regarding the University's **nitrogen footprint** tool; estimation of the **embodied carbon emissions** for UVA's buildings; and, feasibility analysis for on-Grounds anaerobic digestion of biological wastes to produce **renewable natural gas (RNG)** which would partly offset UVA's consumption of fossil natural gas. Similar to DA 2022, the DA+ 2023 program was a positive learning experience for student fellows and faculty and staff mentors. All projects produced meaningful recommendations about initiatives that UVA could pursue to achieve its 2030 and 2050 goals or otherwise uphold and enhance its reputation as a sustainability leader among peer institutions.



1. Inception, Goals, and Structure

The Decarbonization Academy (DA) was launched by the Teaching and Research (T&R) sub-committee of the University's Sustainability Committee in 2022. It was envisioned as a loose assemblage of projects working towards UVA's 2030 and 2050 climate goals, with ample opportunity for exchange of ideas and shared learning experiences. Appendix A summarizes updates and key outcomes arising from DA 2022 projects over the following year (2022-2023).

Based on the success of the 2022 offering, it was decided that the T&R committee would repeat the program in Summer 2023. However, the scope was slightly modified to better reflect the duality of UVA's 2030 goal, whereby the University has committed itself to be carbon-neutral and reduce its nitrogen emissions by 30% relative to 2010 levels. The latter portion had been effectively overlooked during the framing of DA 2022. Therefore, the name of the program was changed to the Decarbonization-Plus Academy ("DA+") for 2023.

As in 2022, the structure of the 2023 academy encompassed two signature components:

I. Hands-on decarbonization learning experiences ("projects")
II. Group-based shared learning activities ("content and connectedness activities")

The following paragraphs provide more detail about each component listed above.

PROJECTS – A list of project topics was assembled by the T&R sub-committee in consultation with other faculty, Facilities Management, Office for Sustainability, and other stakeholders. Candidate projects were included in the application so that applicants could rank their project interests. Fellows were then selected to work full-time (approximately 30-35 hours per week) on a project, individually or in small teams, for the duration of the 8-week program.

CONTENT & CONNECTEDNESS ACTIVITIES – Participants also engaged in two shared learning experiences per week. The first was a two-hour "lunch and learn" session on Tuesday afternoons, introducing important concepts, methodologies/frameworks, and best practices relevant to decarbonization at UVA. The second was a "connectedness" event, constituting a field trip, tour, or other outing later in the week, placing significant emphasis on having fun and learning about UVA. Table 1 summarizes the schedule of DA+ 2023 activities by week.

As in 2022, upper-level undergraduates and grad students in all academic units were eligible to apply. The admissions window was moved forward compared to what had been used in the previous year, in hopes of attracting more candidates (i.e., by reaching potential applicants before they already committed to some other summer program). Unfortunately, this change did not have the desired effect. Instead, the number of applications received in 2023 was markedly lower than in 2022. It was therefore necessary for faculty mentors to actively recruit additional applicants, based on desired expertise, for some projects. Appendix B provides an overview of important administrative dates for 2023. Figure 1 summarizes the breakdown of applications by academic unit and student year for 2023 relative to 2022.

Table 1. Schedule of DA+ 2023 topics and programming by week.

Week	Tuesday Lunch-and-Learn Topic	Thursday Activity
1 (Jun 20)*	DECARBONIZATION 101: A GLOBAL PERSPECTIVE WHAT, WHY, HOW MUCH? [Lead = Lisa]	WELCOME SOCIAL (Popsicles in Darden Court) [Lead = Lisa]
2 (Jun 27, 29)	UTILITIES PLANT TOUR [Leads = Paul, Peter Kowalzik]	DECARBONIZATION 101: A UVA PERSPECTIVE WHAT, WHY, HOW MUCH? [Leads = Paul Zmick & Jesse Warren]
3 (Jul 5, 6)**	BUILT ENVIRONMENT, BUILDINGS, & ENGINEERED APPROACHES [Leads = Ethan Heil, Andres Clarens]	ALDERMAN RENOVATION TOUR [Leads = Kit Meyer, Ethan Heil]
4 (Jul 11, 13)	NATURE-BASED APPROACHES & MORVEN ENVIRONMENTAL HISTORY [Leads = Tim Beatley, Beth Meyer]	WALKING TOUR & FOREST DATA COLLECTION [Lead = Tim Beatley]
5 (Jul 18, 20)	INTERMEDIATE PROGRESS REPORTS I (ORAL) [Lead = Lisa]	MORVEN FARMS TOUR [Lead = Beth Meyer]
6 (July 25, 27)	WASTE, WASTE-to-ENERGY, & CLIMATE [Lead = Lindsay Ivey Burden, Lisa]	FACILITIES MANAGEMENT WASTE AUDIT [Leads = Jesse Warren, Sam Kelly]
7 (Aug 1, 3)	NITROGEN, WATER, & CLIMATE [Leads = Jim G, Libby, Andrew D]	UVA DINING TOUR [Lead = N Team, Caroline Baloga)
8 (Aug 1)	FINAL PRESENTATIONS [Lead = Lisa]	NA

**DA+ 2023 started on a Tuesday, because Monday was a federal holiday*

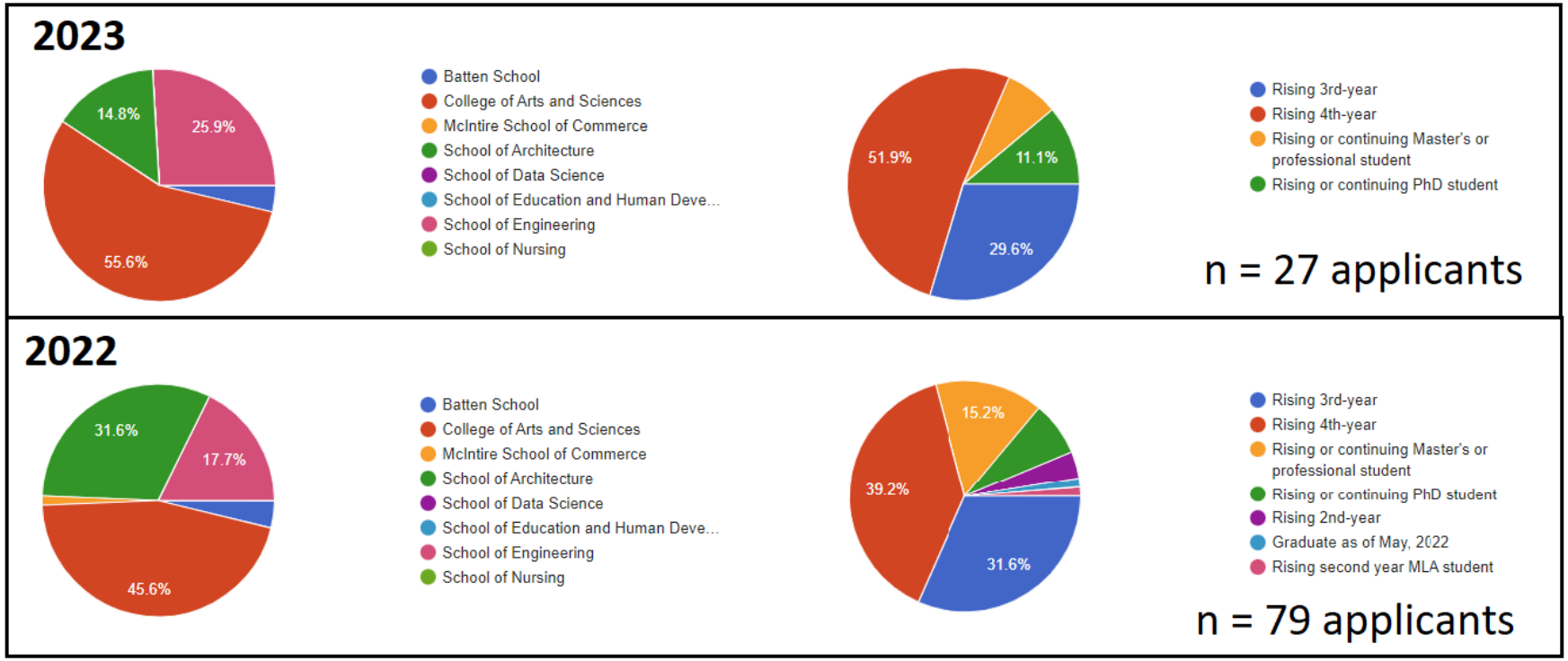


Figure 1. Applicant pool demographics for 2023 (top) and 2022 (bottom). Both panels present distribution of applicants by academic unit (left) and student year (right).

2.0 Projects and Participants

The DA+ program in 2023 comprised thirteen students working on six projects. Two fellows from the new Decarbonization Corps program, organized by UVA's Environmental Institute (EI), also contributed to one of the DA+ projects and routinely attended DA+ events.

Full details on project participants are summarized below. **Bolded font** denotes project nicknames that will be used in the rest of this report. Relevant program abbreviations are spelled out at the end of the participants list.

- **Forest Patches** at UVA

  Student Fellows: Leah Germain, EVSC [BS, 2025]
  Madeline Morphis, UEP and EVSC [BS, 2025]
  Olivia Vargo, EVSC and Global Sustainability [BS, 2024]

  Mentor: Professor Tim Beatley, UEP, School of Architecture

- **Smart** Buildings: Decarbonizing UVA **Labs**

  Student Fellow: Hamidreza ("Reza") Nabaei, Systems Engineering [PhD]

  Mentors: Mr. Ethan Heil, UVA Facilities Management OFS
  Professor Arsalan Heydarian, CEE, SEAS

- **Morven** Farm Phenology

  Student Fellows: Katherine Larson, ETP [BS, 2024]
  Gina Lee, Landscape Architecture [MS]

  Mentors: Professor Beth Meyer, LAR, School of Architecture & Morven

- Community Outreach Regarding **Nitrogen Footprint** Analysis
  [Offered in partnership with UVA's Nitrogen Working Group (NWG)]

  Student Fellows: Olivia Beidler, EVSC and Global Sustainability [BS, 2024]
  Emma Vorathiankul, Global Public Health [BS, 2024]
  Rebecca Wiskewski, EVSC and Biology [BS, 2025]

  Mentors: Ms. Elizabeth Dukes, UVA Facilities Management OFS, NWG
  Mr. Andrew DiSanto [BS, 2023], NWG
  Professor Jim Galloway, EVSC, College of Arts & Sciences, NWG

- **Embodied Building Emissions**

Student Fellows: Anna Abernathy, Civil Engineering [BS 2023, ME 2024]
Kimmie Dela Cerna, Civil Engineering **[Decarb. Corps]**
Anusha Jain, Civil Engineering **[Decarb. Corps]**

Mentors: Mr. Ethan Heil, UVA Facilities Management OFS
Professor Andres Clarens, CEE, SEAS

- Renewable Natural Gas **(RNG)** Production on-Grounds at UVA

Student Fellows: Grey Webbert, CEE [BS, 2024]
Jason Wong, CEE [BS, 2024]

Mentors: Mr. Paul Zmick, UVA Director of Energy and Utilities
Professor Lindsay Ivey Burden, CEE, SEAS

Program Acronyms

CEE = Department of Civil and Environmental Engineering
ETP = Environmental Thought and Practice
EVSC = Department of Environmental Sciences
LAR = Department of Landscape Architecture
OFS = Office for Sustainability
SEAS = School of Engineering and Applied Sciences
UEP = Department of Urban and Environmental Planning

3. Summary of Decarbonization Outcomes

The following subsections comprise brief summaries of each DA+ project, with emphasis on actionable recommendations. The ordering of the projects is essentially arbitrary; however, 2023 projects that were undertaken as continuations of 2022 projects are presented first. Full reports for each individual project are available via an open-access digital appendix (Appendix C).

3.1 Forest Patches at UVA

This project was undertaken as continuation of DA 2022's project, "Natured-based Solutions."

Summary. Nature-based solutions encompass a broad range of planning, design, and engineering practices that integrate natural features into the built environment. This study evaluated how on-Grounds trees and forests can contribute to achievement of UVA's 2030 and 2050 goals, while also delivering critical ecosystem services and promoting physical and mental health. This project was distinct from other DA+ projects insofar as it explored direct CO2 sequestration (uptake by plants), as opposed to emissions reductions alone, as means to reach net carbon neutrality. The team updated data collected last year (via DA 2022) for many of the ~100 most "significant" trees on Grounds, making multiple measurements per tree and then estimating the amount of carbon embodied in UVA's existing tree stock and the amount of CO2 taken up per year by trees.

This year's nature-based solutions team was primarily focused on one specific nature-based approach known as "forest patches", which they defined as "places where forest vegetation is spontaneously regenerating and predominantly self-organizing, located within a matrix of urban land uses". They conducted a GIS-based assessment of UVA's existing forest patches, quantifying their areal footprint, cataloging current species inventories for each location, and estimating that they collectively take up approximately 13,000 metric tonnnes CO2-eq per year. This value corresponds to 8% of UVA's annual emissions as of 2021. The team also conducted GIS analysis and in-person assessments to identify good candidate locations for installation of new forest patches. They worked with Facilities Management to finalize and prioritize this list, ultimately settling on five new locations. The project team then developed detailed proposals for planting and management at three of the five sites. They also formulated plans for fostering community involvement and educational outreach related to the new installations. The team continues to partner with Facilities Management, and the three new sites are expected to be installed over the coming 2022-2023 academic year. The team has created an ArcGIS Story Map (Figure 2) to collect information about the project as it continues to move forward.

Recommendations:

UVA should continue to support installation and maintenance of the proposed forest patches. Students should continue to lead all components of the work (e.g., via classes, supervised research, and/or capstone projects), including future monitoring to quantify CO2 uptake and other benefits. The new forest patches will constitute a valuable fusion of stewardship and Grounds-engaged learning.

Figure 2. (Left) Proposed signage for new forest patches installations, to help UVA community members and visitors learn about forest patches. (Right) A screenshot from the team's Story Map. Darker green denotes existing forest patches, which are located mostly to the north and west of Central Grounds. Pink denotes proposed locations for new forest patches.

3.2 Smart Labs

This project was undertaken as continuation of DA 2022's project, "Decarbonizing Buildings".

Summary. This year's relatively small applicant pool did not yield the desired number of students interested in continuing the buildings decarbonization "roadmap" project from DA 2022. However, one applicant was a SEAS PhD student pursuing dissertation research related to "smart buildings"; i.e., the use of real-time sensing and building automation systems (BAS) to deliver enhanced sustainability, health, occupant comfort, or other outcomes. It was therefore decided that this year's buildings decarbonization project would focus on developing a dashboard to automate HVAC decision-making in UVA labs, since they account for an outsized portion of UVA's overall building energy use.

For safety reasons, the recommended air change rate (ACR) for laboratories is markedly higher than in other spaces. However, there was anecdotal evidence that many of UVA's labs were using ACRs much higher than the recommended threshold. It was therefore hypothesized that implementation of automated sensing and control for lab ventilation systems could reduce excessive ventilation, thereby reducing energy use, emissions, and cost (Figure 3). The student leading this project computed ACR values for approximately 45 labs in the Physical and Life Sciences Building (PLSB). His calculations revealed that actual ventilation rates varied markedly, from 3.6 to 57.3 CPH ("changes per hour"), with more than 70% of the labs ventilating at rates higher than the goal value of 8 CPH. The average ACR rate observed across all labs in the case study building was 20.7 CPH, which is more than twice the recommended target. The student then developed a control algorithm for the HVAC system in PLSB and created a prototype dashboard for use by UVA's Facilities Management. The student also provided some example calculations to demonstrate how reducing excessive ventilation across all of UVA's labs will deliver appreciable energy, emissions, and cost savings.

Recommendations:

UVA's Facilities Management should continue to support research related to "smart lab" ventilation control – using the PLSB system as a case study. Continued monitoring should be pursued as means to evaluate achievable energy, emissions, and costs savings. It is especially exciting to see that UVA students and faculty conducting unique, cutting-edge research using Grounds as a testbed, which is made possible by strong support and expertise provided by Facilities Management.

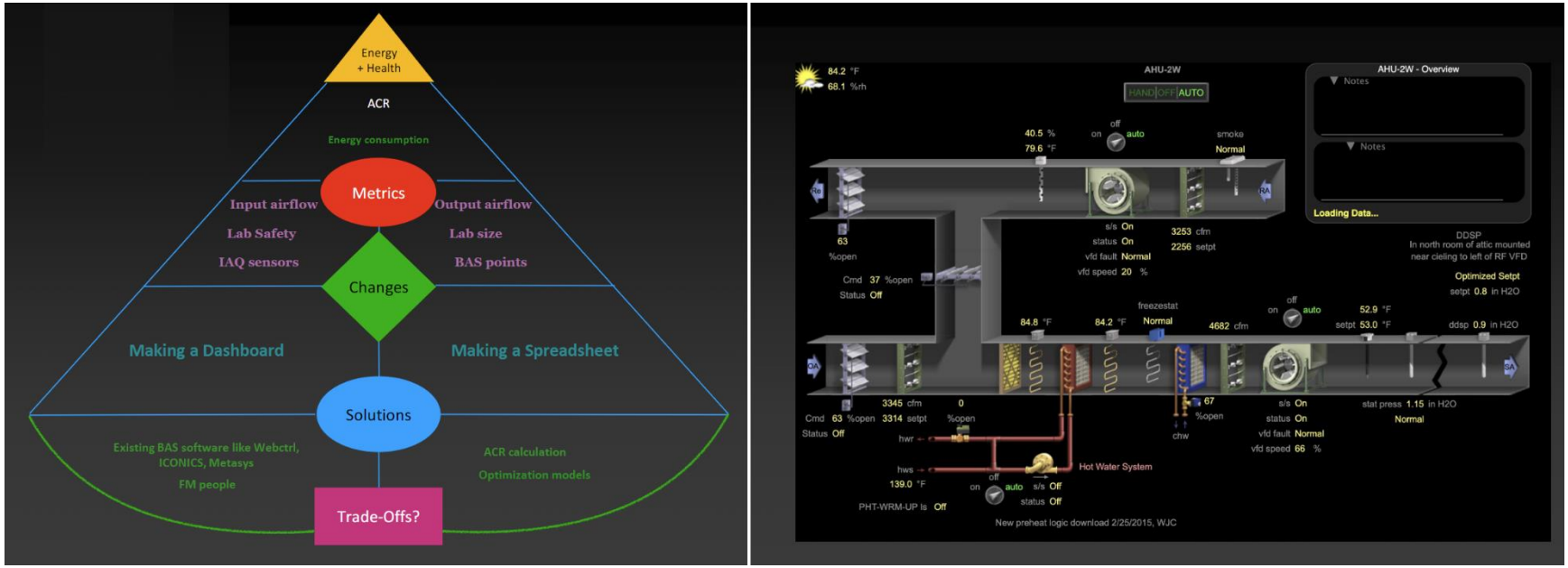


Figure 3. (Left) Schematic representation of the "smart lab ventilation" project progression, starting from GOALS (at the top), continuing to measurements and comparison with benchmark metrics, progressing to implementation of control strategies to change from the current state to an "optimized" state, then finally delivering solutions and assessing what if any tradeoffs exist. (Right) Elements of the HVAC system controlled via the proposed lab ventilation dashboard.

3.3 Morven Farm

Summary. It was announced in early mid-2022 that Morven Farm would become UVA's Sustainability Lab. Therefore, the T&R Committee agreed that it would be valuable to add a Morven project to DA+ 2023. This change would also make the academy less STEM-heavy than it had been in 2022. Two students were recruited to work on the Morven team; one leading a phenology based on farm records dating back to the 1930s, and the other exploring the formal gardens, which were designed and installed by a notable female landscape architect in the 1930s. Both components of the work were motivated by the premise that understanding the history of land management practices at Morven (spanning Monacan stewardship, small tenant farming, plantation agriculture exploiting enslaved labor, landscape of leisure, etc.) is vital to understanding its current landscape and identifying how it can be best leveraged as a site for sustainability investigation. As the team writes in their final report, "[the UVA community] must recognize the unique social and environmental history of the site's past as we simultaneously look towards its future."

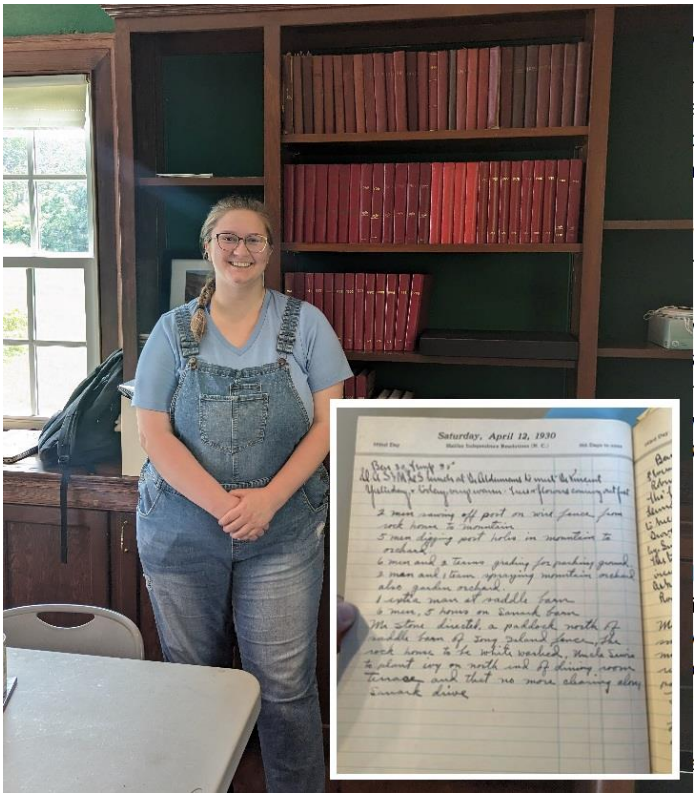


Figure 4. DA+ Fellow Katie Larson stands in front of the Morven Farm journal collection. (Inset) Original farm journal entry for April 12, 1930.

The student leading the phenology study completely transcribed the Morven Farm journal for 1930. She created an online document suitable for accession into UVA's Special Collections Library and compiled a daily weather summary. She also perused the 1931-1934 journals, which correspond to a period of severe drought in Central Virginia, compiling a list of notable events and topics that may be of interest to future Morven researchers.

Recommendations:

UVA should continue to explore how Morven Farm can be best leveraged as a unique location for sustainability investigation, potentially considering whether it could become a permanent home for the Decarbonization-Plus Academy.

3.4 Nitrogen Footprinting

Summary. Over the last decade, UVA's Nitrogen Working Group (NWG) has collaborated effectively with internal partners such as Facilities Management, Dining, Health, and Darden to create and implement the university's 2030 Nitrogen Action Plan (NAP). For their DA+ 2023 project, the team focused on quantifying UVA's contribution to N emissions via several pathways that are currently excluded from the scope of the NAP, including: nitrogen fertilizer application at UVA-affiliated golf courses, off-Grounds student housing, and agricultural operations at UVA's Morven Farm (Figure 5). These entities are affiliated with UVA, but their activities are not currently included within the pledged N reductions. The team also examined two possible means of mitigating N emissions in the larger Charlottesville-Albemarle region: by estimating what reductions would accrue if all local commercial buildings were upgraded to Energy Star compatibility, and by investigating relationships between homeowners' association (HOA) membership and N emissions. Results from this study reveal that UVA's golf courses, off-Grounds student housing, and university-owned properties (i.e., Morven Farms) are emitting substantial amounts of reactive N, even though these emissions are not currently accounted for in the pledged goals. Additional results highlight the value of making further refinements to the NWG's *Community Nitrogen Footprint Tool* so that it can better quantify current N emissions from buildings and neighborhoods and help evaluate what improvements could be achieved via various initiatives.

Recommendations:

UVA should consider amending its nitrogen goals to include affiliated entities such as the golf course, off-Ground student housing, and Morven Farms, since it has been documented that they contribute to reactive N emissions in a meaningful way.

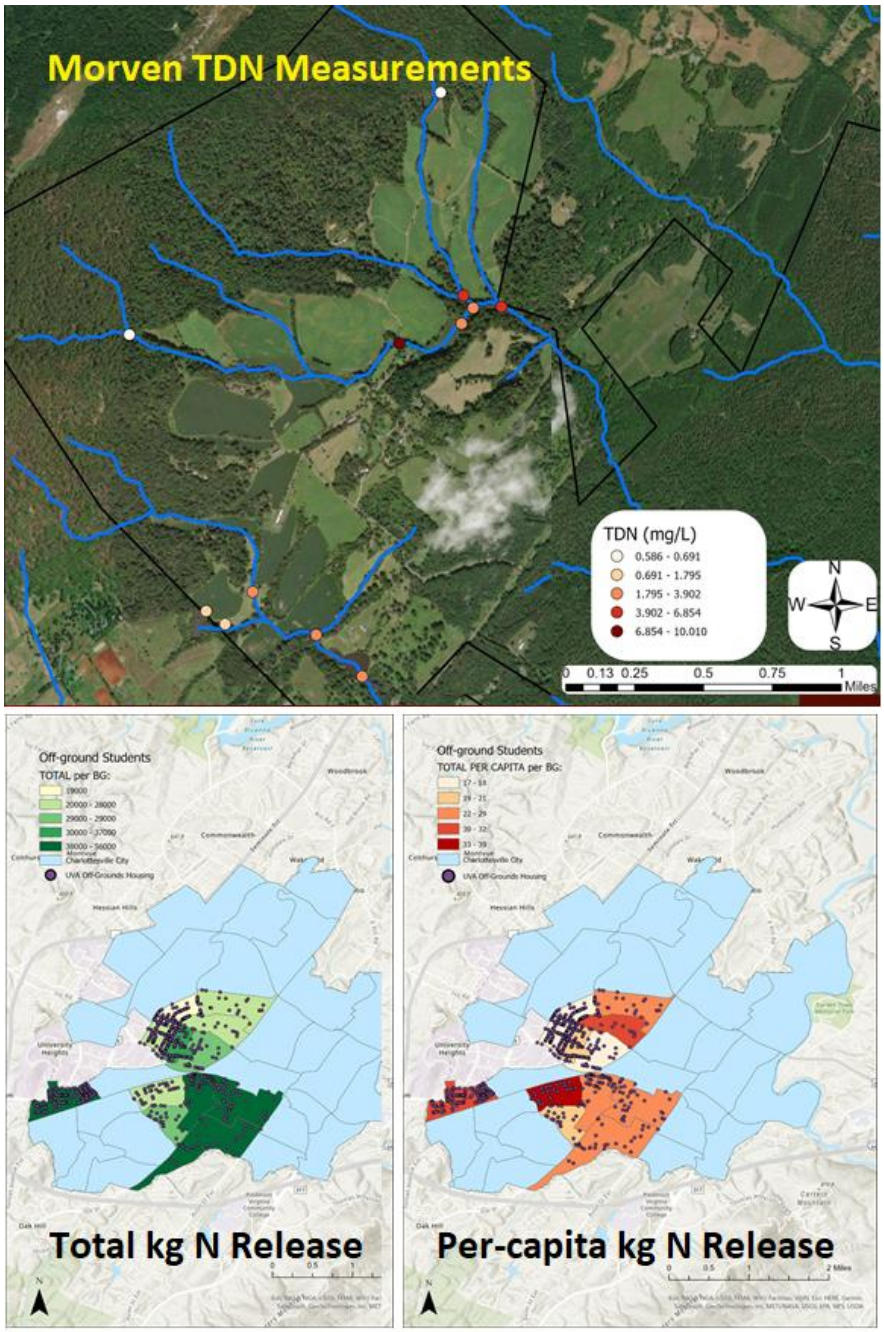


Figure 5. (upper) Measured concentrations of total dissolved nitrogen (TDN) for grab samples from locations in or near Morven Farm, as collected by DA+ fellows (and NWG members) during Summer 2023. These results suggest that current agricultural practices at Morven are indeed releasing reactive N to local waterways. (lower) Total and per-capita N release in selected census blocks adjacent to UVA containing significant off-Grounds student housing. The difference between the two panels reveals that higher total emissions in some blocks is not currently correlated with higher per-capita release, suggesting lower N emissions per person than previously estimated for high-density student housing and/or undercounting of students during the most recent census.

3.5 Embodied Building Emissions

Summary. The University's current carbon goals encompass only Scope 1 and Scope 2 emissions (i.e., direct emissions from on-Grounds combustion and indirect emissions arising from production of electricity purchased for use on Grounds, respectively), though there is growing concern about the need to address certain classes of Scope 3 emissions. There is particular desire to understand what "embodied carbon emissions" are accounted for in UVA's buildings; i.e., what greenhouse gas emissions (GHG) are associated with the production and transportation of raw building materials, construction, and demolition of each building. This assessment is complicated because UVA has many buildings that were built at different points over its long history using different building materials. Also, greenhouse gases do not exist permanently in the atmosphere.

The embodied emissions team had three main goals: 1) compute total embodied carbon emissions for all existing UVA buildings; 2) estimate what amount of historical embodied building emissions are still present in the atmosphere (based on building age); and 3) evaluate to what extent changes in building construction materials could mitigate the embodied emissions of UVA's building portfolio over time. Successful achievement of these goals is valuable for understanding the relative magnitudes of annualized embodied emissions (total embodied emissions divided by years of building life) versus operational emissions per year for any individual building and, more broadly, for prioritizing when and how individual buildings should be renovated to minimize their overall climate impacts.

The completed analysis encompassed 487 out of UVA's 500 buildings, providing estimates of total embodied emissions with and without correction for GHG decay over time. The results were mapped in GIS. The estimate of total embodied carbon emissions across all buildings without adjustment for GHG decay over time was 1,640,300 MTCO2eq. The corresponding value with adjustment for GHG decay over time was 822,040 MTCO2eq (46 kg CO_2eq/ft^2 when normalized on a square-footage basis) (Figures 6A & 6B). These estimates with and without time adjustment are ~10-fold and ~5-fold larger, respectively, than operational emissions per year as of 2021 (Figure 6C). Finally, once the baseline estimate was computed, scenario analysis was used to evaluate several possible mitigation approaches making use of lower carbon-footprint building materials. Results from this analysis reveal potentially promising benefits from adoption of novel building materials such as mass timber and hypothetical low-carbon cements (Figure 6D).

Recommendations:

UVA should revisit the decision to exclude embodied carbon emissions of buildings from its decarbonization goals. It should also incorporate information about embodied emissions into its prioritization of building renovations and decision-making related to building materials.

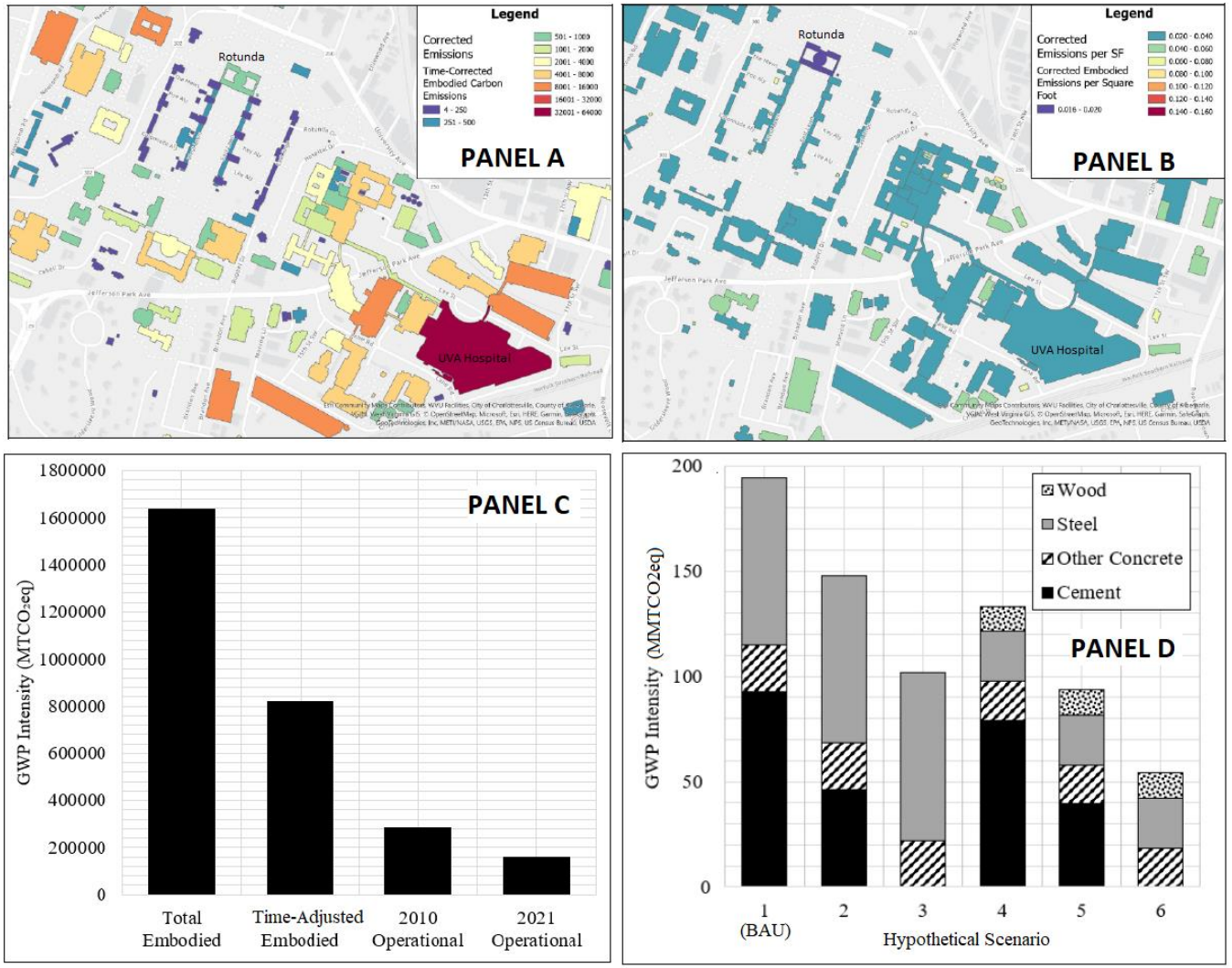
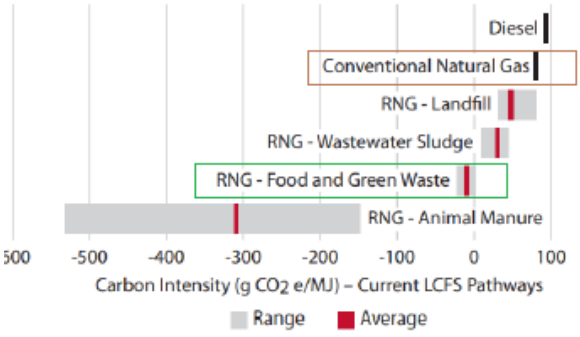


Figure 7. (upper) GIS visualizations of embodied carbon emissions for UVA buildings with adjustment for GHG over time (Panel A) and with normalization by square footage (Panel B). (lower) Comparison of embodied and operational emissions for UVA buildings based on baseline calculations (Panel C) and with accounting for hypothetical future scenarios involving lower-carbon building materials (Panel D). BAU = business as usual; i.e., no anticipated change in selection of building materials.

3.6 Renewable Natural Gas (RNG)

Summary. A significant finding of UVA's *Strategic Thermal Energy Study* (STES, 2022) was that UVA will need to significantly reduce its consumption of fossil natural gas to meet its decarbonization goals, even though it will still need natural gas as fuel, especially at the hospital. This means that the university must secure access to "renewable natural gas" (RNG); i.e., a form of methane (CH4) that delivers equivalent heating content to fossil natural gas but has significantly reduced carbon intensity because it is derived from biological feedstocks instead of fossil sources (Figure 8). The RNG team was tasked with contributing to a technical feasibility analysis conducted by an external engineering consulting firm. The goal of the overall analysis was to estimate the economic costs and possible decarbonization benefits of constructing an on-Grounds anaerobic digestion facility that would convert a fraction of UVA's biological wastes (currently composted) into RNG. The DA+ fellows working on the RNG project had four sub-tasks contributing to the overall analysis: 1) updating and confirming estimates of pre- and post-consumer food waste per year from UVA dining halls and other facilities; 2) inventorying any other possible digestion feedstocks; 3) estimating what fraction of UVA's historical natural gas consumption could be offset by RNG produced in the hypothetical facility; and 4) and estimating what area would be required for land application of the digestate residuals (a wet slurry waste produced during digestion).



Source: World Resources Institute, Renewable Natural Gas as a Climate Strategy: Guidance for State Policymakers

Figure 8. Carbon intensity for fossil natural gas (brown box) and RNG produced from food waste (green box) or other sources.

Results from the team's preliminary analysis reveal that the proposed digestion system could produce enough RNG to offset approximately 0.3% of the historical natural gas demand at UVA's Main Health Plant. This amount is limited by feedstock availability; whereby, for every additional 0.1% of natural gas offset desired, an additional 170 tons of food waste is required. On the other hand, the relatively small size of the digester operation that is currently achievable based on existing feedstock availability makes it such that all of the projected solid and liquid digestate could be consumed on Grounds or at UVA-affiliated properties (e.g., Morven Farm or Birdwood Golf Course). As of this writing of this report, the engineering consulting firm had not delivered their final report.

Recommendations:

UVA should use the data from the forthcoming engineering analysis to estimate the decarbonization cost arising from the proposed digester system (in $/kg CO2-eq avoided), with accounting not only for offsetting of fossil natural gas but also consideration of avoided compost transportation impacts.

4. Other Outcomes, Critique, and Next Steps

In addition to specific recommendations arising from the various projects (Section 3), there were several additional positive outcomes from DA+ in 2023. These include:

- **Productive collaboration with Morven**, yielding at least two kinds of significant benefits. First, the projects less STEM-heavy than in 2022, which had been a key criticism of the initial DA offering. Secondly, it was valuable to build relationships among faculty teaching and conducting sustainability research and individuals working at Morven. Now that Morven is the home for sustainability-related teaching and outreach, it makes sense for the Decarbonization Academy to have a "home" there. It might make sense for the future DA offerings to have its administrative home at Morven.

- **Productive collaboration between faculty/students and Facilities Management (FM) –** as in 2022, the DA projects mentored and/or co-mentored by pairs of faculty and FM staff were very productive means of training students, generating new knowledge (e.g., the "smart labs" work that will form part of a PhD student's dissertation research), and allowing faculty and staff to share expertise and experiences with one another. In addition to several faculty + FM staff pairings that were repeated from last year, there were several new pairings made possible by this year's project offerings.

- **Meaningful interaction between DA and EI (and NWG!)** – it was helpful for T&R's *Decarbonization Academy* to occur in parallel with the Environmental Institute's *Decarbonization Corps*. Students participating in both programs were afforded access to a broader array of perspectives and experiences than would have been possible if either program had been operating on its own. It was also valuable for faculty and staff members participating in each program to learn about the other offering. Relatedly, it was valuable to have UVA's well-established and highly visible Nitrogen Working Group (NWG) represented in this year's DA+ offerings. That team has a strong track record of producing innovative, impactful work. It was valuable to be able to support and highlight their research using DA resources.

Finally, it is useful to critique this year's program as means to potentially improve future offerings. The bullet points below summarize "lessons learned" from offerings in 2022 and 2023.

- **Uneven student experiences** – students working mostly alone (either because they were not part of a team, their team was sub-divided into essentially independent sub-tasks, or because members of their team were not able to work in-person for the full duration of the program) reported feelings of disappointment, isolation, and frustration. This was especially true for the fellows whose projects were not located near to other teams. In the future, assignment of students into teams should take into consideration where each fellow will work and who they will work with over the full duration of the experience.

- **Administrative challenges** – it is challenging to administer a program that compensates both faculty and staff outside of an academic home unit. For 2022, Facilities Management staff assisted with administrative functions (e.g., HR, student wages, faculty compensation). For 2023, this responsibility was moved to the Provost's Office. As a result of this change and/or the full transition to Workday, administration of the 2023 offering was much more logistically challenging than in 2022. As of the writing of this report, not all participating faculty members have been compensated for their work. This is not the fault of any particular staff member(s), but rather an outgrowth of how awkward it is to operate a program like this without a clearly defined academic home unit.

- **Closing the loop** – one final critique of the 2022 and 2023 offerings is that it's not obvious what bearing, if any, the completed work has on decision-making or is accessible to other stakeholders. A possible goal for future offerings could be to brainstorm ways to disseminate the completed work to a broader audience.

Appendix A – Highlighted Updates from DA 2022 Projects

The full list of Decarbonization Academy projects from 2022 includes:

- Carbon Accounting and Offsets
- Thermal Energy Meta-Decarbonization Study
- Building and Plant Thermal Engagement Study
- Geoexchange
- Building Decarbonization
- Building Occupant Behavior Change
- Nature-Based Solutions

Of these seven, two projects had especially significant outcomes occurring over the course of the following year (AY 2022-2023). Brief updates are provided below. Full reports for all DA 2022 projects can be accessed via this digital archive.

Carbon Accounting and Offsets

In late October 2022, the co-chairs of the University Committee on Sustainability appointed a *Carbon Offsets Taskforce* to make recommendations on how UVA should approach carbon offsets as part of its overall strategy to meet the 2030 carbon neutrality goal. The taskforce was comprised of eleven members, including two student members and two faculty co-chairs. Both student members were DA 2022 fellows, and their DA mentor, Professor Bill Shobe, was a taskforce co-chair. The group met virtually over the course of the 2022-2023 academic year, finally presenting their recommended framework to the Committee on Sustainability in May 2023. Elements of their issued guidance are consistent with the outcomes of the DA 2022 project, and their recommendations summary document makes reference to the DA 2022 final report.

Building Decarbonization

The 2022 Buildings Decarbonization project was mentored by Mr. Ethan Heil of Facilities Management's Office for Sustainability (OFS). At around the same time, Ethan also served as UVA's representative to a working group convened by the US Department of Energy (DOE): the *Better Climate Challenge Emissions Reduction Planning Working Group*. This group was tasked with developing guidance for emissions reductions planning among building portfolio owners. Early in the process, Ethan shared the work that his DA team helped develop during Summer 2022, specifically their building decarbonization roadmaps and prioritization tools. In Ethan's words, *"The DA-developed roadmaps ended up seeding the framework and important decision criteria that made it into the final guidance that was recently published. There's obviously a lot of additional input and effort that went into the DOE document, but I've heard from the chairs that the roadmaps were an important resource that helped set the direction and form of the final product."* Examples of DOE's final guidance documents are available via an addendum to the team's final report. Relevant materials are also accessible via DOE's online portal.

Appendix B – Timeline and Budget

Table B1. Important dates for the 2023 Decarbonization-Plus Academy

Milestone	Date
Applications open	February 6, 2023
Applications close	March 13, 2023 (after Spring Break)
Participants are notified	March 23 – April 19, 2023 (multiple rounds)
Program begins	June 20, 2023
Midterm deliverables due	July 18-21, 2023
Program ends	August 11, 2023
Synthesis report delivered	September 30, 2023

Table B2. Forecasted and actual budget for Decarbonization-Plus Academy 2023.

Item	Budget Forecast (May 2023)	Budget Actual (September 2023)
Project Costs (Students + Mentors)	$92,000	$80,473
Paid Student Fellows (n = 12)	*$60,000*	*$56,473**
Paid Mentors (n = 8)	*$32,000*	*$24,000***
Director	$8,000	$8,000
Events (meals, social events)	$3,200	$2,539
Other (supplies for Nitrogen team)	$0	$1,004
Total	$106,200	$92,016

*Not all fellows ended up working full-time for the full 8-weeks duration.
**We've had ongoing administrative difficulties paying two mentors.

Appendix C – Digital Repository of Full Reports

All six final reports are maintained in a UVA Box folder. They can be accessed using this link: https://virginia.box.com/s/g15rizhnmnne8py5j6xlg4zwn933ozg8