

Denison University

Green Hill Fund

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Summary

Location: Granville, OH

Student enrollment: 2,385

Combined gross square footage of all buildings on campus: 1,886,513

Endowment: \$682.5 million

Type: Private

This case study was supported by generous contributions from: David Rockefeller Fund, Kresge Foundation, Merck Family Fund, Roy A. Hunt Foundation, and Wallace Global Fund.

Denison University's Green Hill Fund began in 2011 and was the product of collaboration among sustainability, facilities, and finance staff. The Fund has leveraged both Denison's commitment to reduce energy use, and the number of opportunities for efficiency projects on campus, to become a key driver for capital improvement and achieving carbon neutrality by 2030. The Fund has drawn primarily from a project pipeline established by facilities staff through auditing from

an outside company and is overseen by the Campus Sustainability Coordinator.

Throughout its design and implementation, the Green Hill Fund has benefitted from the support and encouragement of decision makers at all levels of Denison's administration. This has allowed the Fund to identify projects, build its operating and accounting structure, and invest hundreds of thousands of dollars in a relatively short amount of time. Initial projects focused on lighting, HVAC, and improving metering on campus, and staff are beginning to consider more comprehensive retrofits as well as solar and geothermal for the future. Looking forward, Green Hill Fund managers are focused on improving their ability to measure and track energy usage to calculate savings and also further engaging students to plan and propose projects.

History

An Opportunity to Harness Savings

After hiring a sustainability coordinator in 2009, Denison University was taking steps to become a more sustainable and efficient campus. The campus performed a university-wide energy audit in early 2011 with an outside company, Perfection Group, to assess the energy conservation measures (ECMs) that Denison could conduct. Also in early 2011, Jeremy King, Denison's Campus Sustainability Coordinator, was introduced to the green revolving fund (GRF) model through the Billion Dollar Green Challenge. The campus had been preparing to undertake numerous energy efficiency upgrades, and King saw the opportunity to harness the financial savings from sustainability projects with a GRF.¹

“We looked at energy performance contracts, but we would rather fund a project and then [the savings are] ours immediately,” said King. “These are smart investments that pay themselves off and allow you to keep investing into the future.”

“GRFs are a perfect example of the economic viability part of the triple bottom line of sustainability.”

At the end of the 2010-2011 fiscal year, Denison's Plant Adaptation and Renewal Funds (PAR Funds), a portion of the annual operating budget spent on capital improvements, had approximately \$1 million left over. The university typically budgets about \$7 million a year to PAR Funds, which enable Denison to maintain the physical plant and minimize deferred maintenance.² King thought this was the perfect opportunity to seed a revolving fund since energy efficiency projects often overlap with the capital improvements that PAR Funds typically finance.

King then took the idea of creating a GRF to Denison's Director of Facilities, Art Chonko, and the Vice President of Finance and Management, Seth Patton.

“The beauty of [a GRF] is that typically those projects do have some financial benefit long term,

which isn't always the case with PAR projects," said Patton. "You don't have to convince me to invest in these projects!"

Chonko and Patton agreed that using a GRF to fund energy efficiency on campus was a good opportunity, and along with King sought to calculate the potential return on investment (ROI) from the energy audit's project opportunities in order to build their case for a GRF at Denison. The team then pitched the idea to then-President Dale Knobel, who approved of the projected financial savings and allocated a portion of the PAR Funds and some designated and restricted gifts to capitalize Denison's GRF (called the Green Hill Fund) with \$1 million. Soon after, in the summer of 2011, the Green Hill Fund began financing projects.



The Bryant Arts Center is a prominent building on campus and has 44,735 square feet of indoor conditioned space. The upgrades in Bryant resulted in reduced electrical use and natural gas consumption, and have saved the campus approximately \$57,390 every year since they were completed.

Operations

Green Hill Fund Overview

Year created: 2011

Size: \$1,000,000; \$3,000,000 by 2016

Source: Plant Adaptation and Renewal (PAR) Funds, a portion of the Operating Budget

Average payback period: 5.8 years

Administrators: Campus Sustainability Coordinator, Director of Facilities, and Vice President of Finance and Management

Average return on investment: 17.7 percent³

input from the facilities team, Denison assembled an initial list of 70 shovel-ready projects.⁴ “We got moving forward with projects themselves, to some extent ahead of our ability to track the energy savings well,” explained Patton. “We went ahead with them with the full intention of trying to catch up with all the information after the fact.”

Denison’s practice of implementing projects ahead of their ability to track savings did not hinder the Green Hill Fund’s operation. The Fund’s managers decided to base repayments to the GRF on estimated savings until more precise measurement was in place. Denison was thus able to move forward on projects that created both cost savings and a visible impact on campus, while simultaneously developing their mechanisms for tracking energy savings.

Identifying the First Round of Projects

During the first two years of the Green Hill Fund’s operation, Denison prioritized installing projects even if tracking and measurement systems were not yet in place. The campus was in an especially strong position to launch their fund as they already had a list of ECMs identified through their 2011 energy audit. With additional

Choosing the Right Projects

Potential projects for the Green Hill Fund are evaluated on a number of criteria:

- Low implementation cost,
- High opportunity for cost savings,
- Estimated payback period,
- Ease of implementation (time, complexity, disruption),

- Significant greenhouse gas emissions reduction,
- Significant educational or research potential,
- Significant social benefit,
- Opportunities for partnership and collaboration within Denison and with the surrounding community,
- High campus stakeholder buy-in and participation, and
- Ability for long-term success.

Managing the Green Hill Fund

The main managers for the Green Hill Fund are King, Patton, Chonko, Bob Jude, a campus Energy and Project Specialist, and Cathy Untied, the university Controller. The team follows a guiding document that outlines the operating procedures of the fund, created by King in the first year of operation.

Once a project has been approved, the Accounting Office will direct funds from the GRF into a project-specific account. Depending on the project, the Facilities Services Department or an outside contractor will handle implementation and install equipment.⁵ Jude keeps track of rebates for the Green Hill Fund, while Chonko manages energy efficiency project implementation and King tracks related project savings.

Starting in 2013, the Green Hill Fund began to solicit project ideas from the entire campus community, designating \$50,000 per year to finance community-initiated projects proposed by students, staff, and faculty. The Campus

Sustainability Committee (CSC) has a protocol for reviewing and deciding which sustainability projects to finance from the campus community. Denison also operates a second sustainability fund called the Environmental Venture Fund, a non-revolving \$10,000 fund to finance projects that support the community, such as curriculum development or recycling initiatives. Students, staff, and faculty apply with a sustainability or energy efficiency project to the CSC. From there, the CSC reviews applications on a rolling basis, determining if the project should be financed by the Green Hill Fund or the Environmental Venture Fund, with energy and water conservation projects going to the former.

Looking forward, the team is planning to finance \$500,000 of energy efficiency projects per year. Of that, \$450,000 of proposed work comes from the Facilities team and are presented with projected return estimates to the CSC for further comments and recommendations. Depending on the year, this process will happen only once or twice. The CSC has nine elected positions and is made up of students, faculty, administrative staff, and support staff. After the committee reviews the proposals, King, Chonko, and the facilities team prioritize which projects to implement. Payback periods of three years or sooner are preferred.

Simple Tracking and Accounting

The Green Hill Fund's measurement of energy- and resource-savings is based on both realized and estimated data. Obtaining realized data for some projects is simple because most campus buildings have electricity submeters installed. Savings calculations take into account previous university spending on electricity over the past 3 years and any changes that occurred after project installation. While no individual ECM (e.g. a lighting upgrade) is attached to a meter, Denison uses both engineering estimates and real-time whole building data to calculate the amount of energy savings. In the future, Denison plans to normalize their estimated savings data for weather variations, providing an even more accurate view of a project's impact.⁶

More Meters, Better Tracking

The Green Hill Fund also invests in projects that improve metering on campus to increase the level of possible measurement and verification for the Fund. One such campus-wide project will help many future HVAC projects observe energy use. By installing condensate flow meters around campus, a \$36,102 project, the Facilities team will be able to measure steam usage from all buildings. Each meter is attached to five or six buildings, and steam savings at the building level can be estimated based on this data. While implementing these meters does not result in direct financial savings for the university, the meters will allow Chonko and his team to diagnose problems and determine the efficiency of the system and steam savings from the



Two of Denison's residence halls, Curtis East and West Halls, underwent a \$22,369 and a \$11,394 lighting upgrade, respectively. The payback time for lighting projects in both these buildings is expected to be just over three years.

Green Hill Fund and additional projects. The Fund plans to recoup the project cost of these meters by bundling it with other projects that have faster paybacks and higher returns.⁷

The Project Repayment Process

The Green Hill Fund verifies energy savings at the end of each fiscal year and then makes a payment from the utilities budget to the GRF based on 100 percent of the calculated project savings. This savings payment will continue each year until 100 percent of the project cost has been recouped by the Green Hill Fund. During a project's repayment period, Denison maintains the utilities portion of the operating budget so that it can continue paying back cost savings to the Green Hill Fund. Once the project has been repaid and the annual cost of utilities has decreased, savings accrue to the operating budget. Based on these savings, increased utilities prices, and overall campus utility use, Denison is able to determine how much to decrease the operating budget.⁸

Performance

Cumulative Project Data

Out of the 56 projects that the Green Hill Fund has financed, 49 are lighting upgrades that were installed between 2011 and 2013. In the first year of the fund's operation, fiscal year 2012, it financed lighting upgrades in 33 residential buildings on campus. In the second year, lighting upgrades were completed in an additional 16 academic buildings as well as HVAC and controls ECMs in three different buildings: Bryant Arts Center, Barney Davis Hall, and the Burton D. Morgan Center. These buildings were chosen because of their high visibility on campus, such as Barney Davis Hall, where the McPhail Center for Environmental Studies is housed. In total, \$411,186 was invested in ECMs in these three buildings.

In the first two fiscal years of the Green Hill Fund, Denison saved \$301,523. Chonko and King calculated that this avoided approximately 19,590.9 million british thermal units (MMBTU) or 5,741,536.7 kilowatt-hours (kWh) in energy use; these figures result from both electricity and natural gas savings.

To date, Green Hill Fund energy projects have abated over 3,346 metric tons of carbon dioxide equivalent emissions (MTCO_{2e}), with the university on track to save 1,874 MTCO_{2e} each year.⁹

With these savings, Denison will be able to reduce their annual carbon emissions by 6.9 percent, using the 2013 fiscal year as a baseline, supporting Denison's Presidents' Climate Commitment goal of carbon neutrality by 2030.¹⁰

The average annual ROI for projects funded in the first two years was 17.7¹¹ percent, with an average project payback period of 5.8 years.¹²

With dozens of projects to finance during the first two years of the fund's operation, Denison invested \$1,231,897 towards their GRF projects. During that period, they also received \$133,562

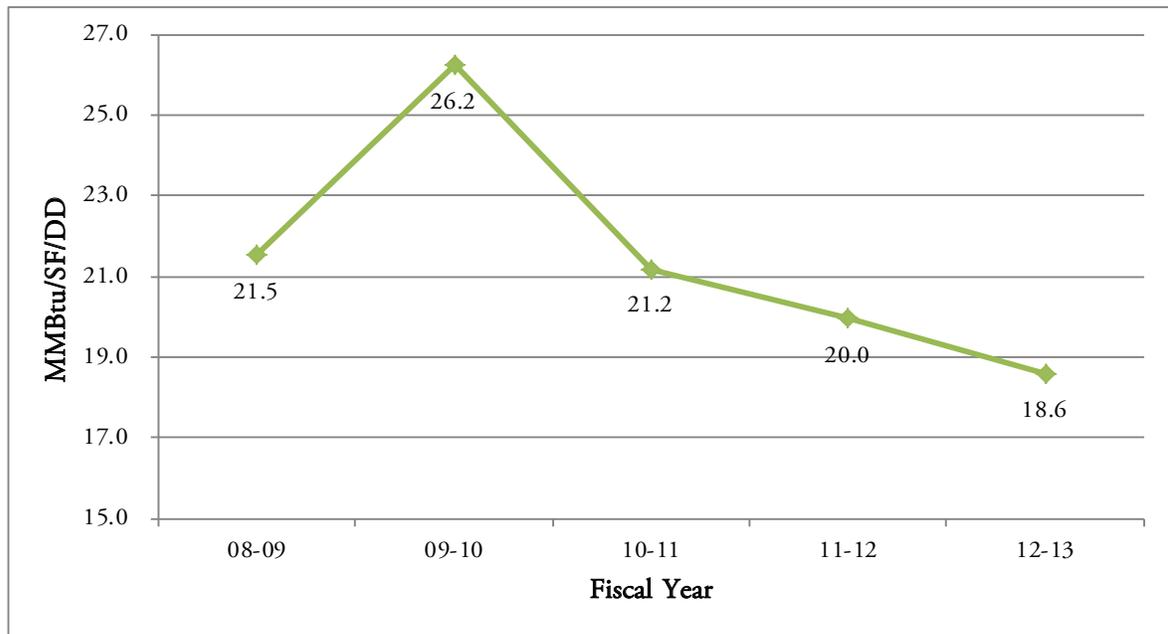
in rebates, mainly from their utility company, American Electric Power, as well as a small amount from the EnerNOC DemandSMART program.¹³

Investing to Identify More Projects

In 2013, the Green Hill Fund took a chance by investing in two large projects with no direct

payback: the condensate flow metering system and a study on the heating plant. The heating plant study was conducted to determine the economic feasibility of switching to natural gas or building a cogeneration facility as opposed to operating on coal as it does currently. Despite no direct cost savings, these projects were chosen because of their ability to help identify and track other Green Hill Fund projects.

Total Heating and Electrical Energy Consumption at Denison University



The impact of Denison's GRF projects can be easily seen when looking at campus energy use, normalized for weather, at Denison. For more information, see page 13, "Reducing Campus Energy Use."

Project Spotlight

Residence Hall Lighting Projects

Project: Lighting upgrades in 33 campus residence halls

Installation completed: December 2011

Average project cost: \$11,373 per building

Simple payback: 5.4 years

Annual return on investment: 10.3 percent

Estimated annual savings: \$66,672

Estimated savings per year: 877,889 kWh

In the fall of 2011, Denison used \$375,025 from the Green Hill Fund on materials and labor to update lighting in all 33 campus residence halls. These lighting upgrades had been identified in the campus energy audit during the summer of 2011, and chosen by King and Chonko for their combined estimated payback period of approximately four years. For the upgrades, estimated savings were calculated by assuming that the residence hall lighting would be on for at least eight hours a day, which was chosen since lights are typically only used for a few hours during the daytime and used for four-to-six hours at night.¹⁴

These upgrades were installed in hallways and in students' rooms, as well as some exterior lighting, and Perfection Group, an outside company, conducted the installations. The work involved switching out T-12 fluorescent bulbs with more efficient T-8 bulbs; in some cases, they installed even higher efficiency T-5 bulbs. The increased brightness from the upgrades meant that in a small number of fixtures, the team reduced the lighting from four bulbs to two or three. Exterior lighting was upgraded from halogen or metal halide to LED.

The lighting upgrades received \$54,381 in rebates from the local utility, American Electric Power Company, which were applied back to the Green Hill Fund. The cost for materials and labor in each residence hall varied greatly, with project costs from \$513 (in Shannon House, 1,800 square feet) to \$50,604 (in Shepardson Hall, 39,073 sq. ft.). The residence halls range in size from a single family home to housing hundreds of students. The average project cost per building for these lighting upgrades was \$11,373.13.¹⁵

Bundling Payback Periods

The payback periods for upgrading each residence hall ranged from 1.3 years (Beta House) to 19.9 years (Huffman Hall). Denison estimates the average (mean) payback period for these projects to be 5.4 years, with a median of 4.3 years.¹⁶ The range in payback periods is due to a number of differences between the buildings including: square footage, prior lighting efficiency, and cost of technology for each upgrade.

Denison financed lighting upgrades in residence halls at the same time to bundle shorter- and longer-term payback periods, which allowed them to implement projects with longer-than-normal payback periods.

Impact of Denison's Lighting Upgrades

Overall, these upgrades save the campus more than 877,889 kWh per year, an annual financial savings of approximately \$66,672 per year. The average lifetime ROI for these projects was 103 percent.¹⁷ For this calculation, a conservative ten-year lifespan was assumed for the lights, although it is possible that many of the lights will last longer. The project has reduced Denison's greenhouse gas emissions by approximately 801.5 metric tons of carbon dioxide equivalent emissions (MTCO₂e) annually.¹⁸

To inform the campus, an email notification went out about these lighting upgrades that detailed the financial and environmental returns the projects would provide. The community has noticed, too, with some Denison students reporting a better quality of light in their dorms.

Bryant Arts Center Energy Conservation Measures

Project: Bryant Arts Center ECM

Installation completed: December 2012

Project cost: \$128,355

Simple payback: 2.0 years

Annual return on investment: 40.0%

Estimated annual savings: \$57,390

Estimated savings per year: 358,426 kWh

An energy audit from Perfection Group also advised Denison to do a number of ECMs on the Bryant Arts Center, a studio arts building with a clay foundry. Art buildings require extensive exhaust ventilation, similar to a laboratory, in order to maintain a safe number of air exchanges each hour. However, constantly circulating outside air requires more heating and cooling, which can dramatically decrease these buildings' energy efficiency.

Perfection Group installed a series of HVAC upgrades and controls in Bryant in the fall of 2012 that targeted air circulation, occupancy, and energy use. A primary focus of this project was to limit the amount of outside air circulation to a safe minimum and implement controls so that air exhaust would increase or decrease depending on building occupancy needs. Perfection Group also installed thermostat controls with occupancy sensors to ensure that heating and cooling systems responded to building use in real-time.¹⁹

The complete controls and HVAC upgrades on the Bryant Arts Center amounted to \$128,355 in materials and labor. The project received a \$13,665 utility rebate. Including the rebate, the expected payback period for the Bryant Arts Center project is two years and the annual ROI is 40.0 percent, estimating a ten year lifespan on the project.²⁰ Bryant Arts is estimated to save 347,381 kWh in electricity and 37,000 centum cubic-feet of natural gas (1,223 MMBTU combined) each year, or the equivalent of \$57,390 in annual financial savings. For Denison's environmental commitment, the project is estimated to save 3190.9 MTCO₂e over 10 years.²¹

Lessons Learned

Getting Students Involved

Sourcing projects from the Facilities team during the first two years was very successful for creating the initial momentum for the Green Hill Fund, but was not as effective at involving members of the campus community. “There were all these projects that we wanted to do, so we didn’t do any formal vetting of projects [from the campus community],” said King.

In the first two years, students were able to participate in a small piece of the Green Hill Fund when they counted light fixtures and computers around campus during the summer of 2011, which helped contribute to energy estimates for the lighting upgrades.

Going forward with the \$50,000 allocated annually from the GRF for student, faculty, and staff-initiated projects, King hopes this will raise awareness of the Green Hill Fund. The types of projects that Denison has currently been funding, such as HVAC upgrades, while reducing the university’s environmental impact, tend to be less visible to the broader community.

“It would be great to have student government or other student organizations more involved with

the Fund,” said King. “With their involvement, we could do less-conservative sustainability projects such as solar or geothermal.”

Reducing Campus Energy Use

The impact of Denison’s GRF projects can be easily seen when looking at campus energy use, normalized for weather, over the past few years at Denison (see graph “Total Heating and Electrical Energy Consumption at Denison University” on page 9). Significantly, the campus MMBtu/square footage/degree day has gone down 13.5 percent between 2008 and 2013. The reductions that occurred during the 2011 academic year and the 2012 academic year correlate with the inception of the Green Hill Fund and the implementation of GRF and other efficiency projects across campus.²² For Denison, the projects have come at a crucial time for the university, as electricity prices have risen 33 percent (from \$0.06 to \$0.08 per kWh).²³ By making its buildings more energy efficient, Denison will counteract the rising utility bills that would have otherwise been incurred.

Looking Forward

Growing the Fund

The community at Denison views the Green Hill Fund as an innovative tool for funding many efficiency projects on campus to the extent that it would benefit from a larger budget. In the fall of 2013, Patton made the decision to grow the Green Hill Fund from \$1 million to \$3 million in the coming years by adding \$500,000 annually from PAR Funds.

“We were convinced that we were early enough in these efforts that it won’t be challenging to find \$3 million worth of good projects to do,” commented Patton. King also supported growing the Fund as a way to finance more projects sooner. “This allows us to think a bit bigger each year,” said King.

This growth will also use any gift funds that are designated for the GRF. While the Denison Major Gifts team knows of the Green Hill Fund and promotes it when appropriate, they are not heavily focusing on raising donations for the Fund. King predicts that they may eventually get smaller gifts from environmentally savvy alumni towards the Fund.

Viewing Waste as Investment Opportunities

Denison has received support from many campus stakeholders and achieved a strong ROI by creating the Green Hill Fund. The Fund plans to give students and members of the community some new responsibility for project applications and selections. During the 2013 academic year the Fund plans to start large ECM projects in two more academic buildings: Olin Science Hall and Blair Knapp Hall, as well as smaller projects in many other buildings.

The financial return on investment for these efficiency projects often exceed the expectations of Denison’s staff.

“Right before we created the fund we replaced lights in the parking garage, which was a really fast payback,” said King. “One of the electricians told me that previously we were spending \$6,000 a month on maintenance in the garage replacing lights and ballasts. Now the new lights have been in for two years and only one has failed out of 600. And that was not even included in the payback!”

Advocates for the GRF

King is a proud spokesperson for the GRF model, and advocates for creating such a fund at any college, university, or other institution.

“Any school can do it since they are already installing energy efficiency upgrades. Every school is doing this as part of their maintenance. If they’re already going to make that investment, why would they not take that opportunity to reinvest that in upgrades in the future through a GRF? Any amount of money would be a good start.”

Endnotes

1 Blank, Shoshana. Phone interview with Jeremy King. July 1, 2013.

2 Blank, Shoshana. Phone interview with Seth Patton. September 25, 2013.

3. Annual ROI is calculated for each individual project as $(\text{Total Lifetime Savings} - \text{Project Cost}) / (\text{Project Cost} \times \text{Number of project lifespan years})$

4 Blank, Shoshana. Phone interview with Jeremy King. March 17, 2014.

5 Denison University. Denison Green Hill Fund Operational Procedures. PDF. August 2012.

6 Blank, Shoshana. Phone interview with Jeremy King. September 3, 2013.

7 Ibid 6.

8 Ibid 2.

9 “The Green Revolving Investment Tracking System.” The Billion Dollar Green Challenge. Accessed March 27, 2014. grits.greenbillion.org.

10 The American College & University Presidents’ Climate Commitment is a network of higher education

institutions that have made commitments towards a carbon neutrality goal. More information can be found at: <http://www.presidentsclimatecommitment.org>.

11 This figure accounts for project rebates. Without rebates, Denison calculates their ROI at approximately 13.9 percent.

12 “2014 DU ECM Update.XLSX.” Excel document. Received March 17, 2014.

13 Ibid. 4.

14 Ibid. 6.

15 Ibid. 12.

16 Ibid. 12.

17 This number includes rebates. Lifetime ROI is calculated as $(\text{Total Lifetime Savings} - \text{Project Cost}) / (\text{Project Cost})$.

18 Ibid. 9.

19 Blank, Shoshana. Phone interview with Arthur Chonko. February 13, 2014.

20 In GRITS, Denison does not attribute the rebate to reduce the project's cost, but instead treats it as a loan repayment. Without the rebate, the payback period is 2.2 years and the annual ROI is 34.7 percent.

21 Ibid. 9.

22 "DU Energy Presentation 2014.pdf." PDF document. Received February 7, 2014.

23 Ibid. 1.