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Green Revolving Funds:
A Guide to Implementation & Management

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Executive Summary

The goal of this Implementation Guide is to provide practical guidance for designing, implementing, and managing a green revolving fund (GRF) at a college, university, or other institution. The GRF model is widespread, with at least 79 funds in operation in North America representing over $111 million in committed investment as of late 2012. GRFs have proven their ability to reduce operating costs and environmental impact while promoting education and engaging stakeholders. The number of GRFs in operation has increased 60 percent since 2010 (see the *Greening the Bottom Line 2012* report).

In 2011, the Sustainable Endowments Institute (SEI) launched The Billion Dollar Green Challenge, an initiative that encourages colleges, universities, and other nonprofit institutions to invest in their own GRFs. As part of this initiative, SEI has researched GRFs at a wide range of institutions and has developed a suite of tools and resources to support GRF adoption (see Chapter 7: The Billion Dollar Green Challenge).

However, it can be difficult to establish and manage an effective GRF. There is a need for a guiding document that taps into the expertise of presidents, administrators, facility managers, sustainability directors, students, consultants, and others with GRF experience to establish best practices. This Guide is intended to fulfill that need.

The Guide is informed by data and insights from schools that have already incorporated GRFs into their campus operations. It leverages insights from (1) interviews with dozens of stakeholders representing institutions that vary in size, setting, and wealth; (2) research conducted by SEI and other organizations; (3) and the direct experience of its authors in implementing and advising on GRFs at a variety of institutions.



University of Colorado Boulder, Center for Innovation and Creativity

Anyone interested in establishing, managing, or researching GRFs will benefit from this Guide. While the Guide is targeted at higher education, its principles can be applied to many other sectors, including K-12 schools, healthcare institutions, municipalities, and private companies.

Chapter 1: What is a Green Revolving Fund?

Chapter 1 introduces readers to the green revolving fund (GRF) concept. A GRF is an internal fund that provides financing to parties within an organization to implement energy efficiency, renewable energy, and other sustainability projects that generate cost savings. These savings are tracked and used to replenish the fund for the next round of green investments, thus establishing a sustainable funding cycle while cutting operating costs and reducing environmental impact. Green revolving funds provide benefits beyond one-time investments, including promoting hands-on learning, enhancing reputation, and building the business case for sustainability.

Chapter 2: The Anatomy of a Green Revolving Fund

No two GRFs are the same. Chapter 2 of this Guide discusses how each component of a GRF can be designed, customized, and optimized for your institution. Sources of GRF seed capital are diverse and include administrative budgets, endowment assets, student fees, and alumni donations. There are also several options for fund oversight, such as the use of a management committee or housing the fund in a specific office. Funds may differ in terms of their project criteria—such as payback requirements or environmental benefits—and whether they track project savings using engineering estimates or empirical measurement.

Chapter 3: 10 Steps to a Successful Green Revolving Fund

Chapter 3 of this Guide includes a step-by-step roadmap for how to design, implement, and manage a successful GRF. A few key themes are present throughout all 10 steps. First, use existing research and strong data analysis to inform building the case for the fund, setting up its structure, and identifying or selecting projects. Second, undertake a thorough stakeholder engagement process, both to build buy-in and to leverage the insights of experts on your campus. Third, tailor the mission and structure of your fund to the unique characteristics of your institution.

Chapter 4: Measurement and Verification of Project Savings

Measurement and verification (M&V) refers to the process of confirming that the savings a project is expected to generate actually materialize after it is implemented. Chapter 4 describes various methods for using estimation, modeling, and metering to determine energy or resource savings generated by GRF projects. Selecting the appropriate method requires consideration of scope, cost, accuracy, data availability, and the type of project being assessed.

Chapter 5: Fund Analytics

Chapter 5 explains common financial and environmental metrics used to forecast, track, and report on GRF performance. From net-present value to greenhouse gas mitigation, project performance metrics allow fund managers to evaluate projects from different perspectives. Simpler metrics are easier for non-technical audiences to understand, while others fill more complex roles such as accounting for the cost of capital or discounting future cash flows. The chapter also provides guidance on analyzing and forecasting the performance of the entire GRF project portfolio, an important part of fund design and management.

Chapter 6: Common Obstacles to Green Revolving Fund Implementation

Several obstacles are often encountered during GRF development and management. Chapter 6 of this Guide outlines those issues and offers best practices for overcoming them based on insights from GRF leaders. To avoid financial obstacles, gain a comprehensive understanding of your institution's accounting system and incentive structure to inform the design of your fund. To overcome administrative and political obstacles, build a strong business case for the fund using performance forecasts and comparisons with peer institutions. To prepare for technical obstacles, develop plans for auditing, M&V, and project repayment ahead of time and with the long-term sustainability of the fund in mind.

To the readers of this guide

Whether you are a student leader excited about reducing your school's carbon footprint, a sustainability coordinator building a strategic plan, a facility manager exploring energy efficiency retrofits, an administrator seeking advice on GRF management strategies, or a researcher interested in sustainability financing mechanisms, we hope you find this Guide to be a useful resource. Through this document, our goal is to facilitate the continued growth of GRFs as an effective tool for cutting expenses, reducing environmental impact, and enriching campus communities.

Chapter 1:

What is a Green Revolving Fund?

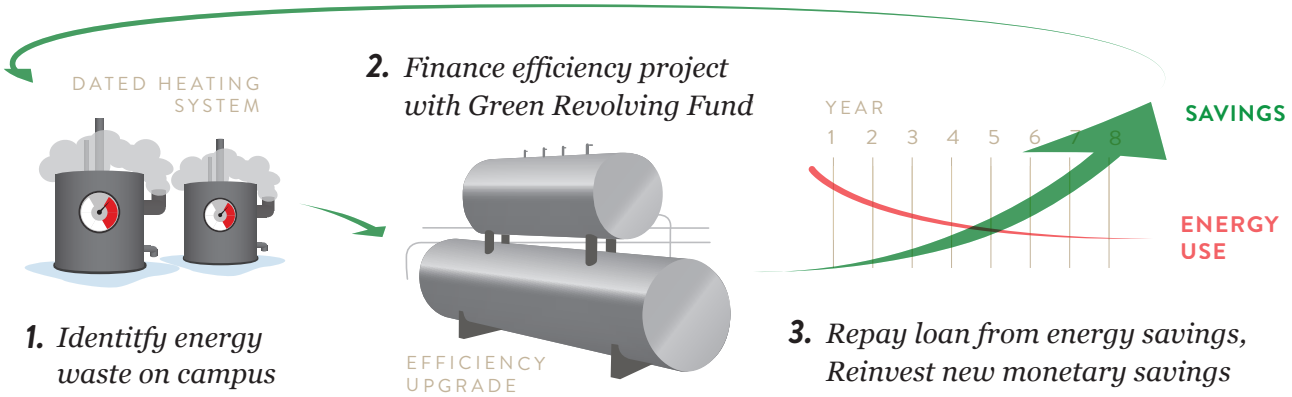
This chapter:

- Provides a high-level overview of the GRF model
- Discusses some common arguments for investing in a GRF

1.1 The green revolving fund model

Facing budget cuts and rising energy costs, many educational institutions are grappling with how to finance urgently needed—but capital intensive—energy efficiency upgrades on campus. One strategy for overcoming these challenges is creating a green revolving fund. A GRF is an internal investment vehicle that provides financing to parties within an organization for implementing energy efficiency, renewable energy, and other sustainability projects that generate cost savings. These savings are tracked and used to replenish the fund for the next round of green investments, thus establishing a sustainable funding cycle while cutting operating costs and reducing environmental impact.

How Green Revolving Funds Work



Green revolving funds are often managed by a committee drawn from different stakeholder groups on campus. These may include students, faculty, facility or energy managers, administrators, sustainability coordinators, and others. Funds may also be managed directly by administrators or by the offices of facilities, finance, or sustainability. While GRFs can finance many types of projects, they typically target energy, water, and waste reduction due to their potential cost savings. Projects have included lighting upgrades, boiler replacements, water pipe insulation, low-flow toilets, building envelope upgrades, solar panels, and more.

After reviewing a variety of funds in higher education, SEI developed the following two criteria for a green revolving fund:

1 The fund must finance measures that reduce resource use (e.g., energy, water, waste) or mitigate greenhouse gas emissions (e.g. renewable energy).

2 The fund must revolve so that at least some of the savings generated by reducing operating expenses are required to be repaid to the fund, thus providing capital for future projects.

1.2 The case for green revolving funds

Non-revolving investments from an operating budget, capital budget, or endowment can also drive improvements in campus environmental performance. So why should you adopt a GRF?

There are several key advantages that revolving funds hold over traditional non-revolving expenditures. Revolving funds:

Demonstrate the business case for sustainability

Despite the large cost-saving potential of energy efficiency and sustainability investments, many institutions perceive them as an expense only. Rather than simply allowing the savings from these projects to be absorbed into the operating budget, a GRF tracks the savings distinctly and directs them into future projects—thus creating a measurable return on investment (ROI). Established GRFs report a median annual ROI of 28 percent (see SEI's *Greening the Bottom Line 2012* report), reliably outperforming average endowment investment returns while hedging against rising energy costs.

Engage and educate the campus community

Whereas traditional capital improvement investments are typically managed by a small team of administrators, a GRF can bring diverse stakeholders together to make decisions about investments and build a sustainability strategy. GRFs can also issue loans to projects proposed by students and other community members, thus promoting entrepreneurship and outside-the-classroom learning.

Convey reputational benefits

A GRF can signal your institution's commitment to sustainability and operational efficiency in a way that one-time investments cannot. It is a unified, purposeful investment vehicle that generates more positive press than conventional top-down investments.

Catalyze a culture shift

A GRF also represents a commitment to larger strategic goals, such as greenhouse gas reductions, and provides a tangible vehicle for achieving them. "A GRF provides constant focus on the idea that you want continuous improvement until you get to a carbon footprint of zero," says Anthony Cortese, Co-Founder and Senior Fellow at Second Nature and Trustee of Tufts University and Green Mountain College. "That doesn't happen if you use debt financing or some other kind of capital financing."

Create a programmatic approach

A GRF creates a formalized program of sustainability investments rather than a series of one-off projects. GRFs typically include specific requirements to ensure fiscal discipline, environmental responsibility, and a clear financing process that funnels savings from past projects into current spending plans. In some cases, this source of funding actually enables projects to be implemented that would otherwise be omitted. For example, the University of New Hampshire historically struggled with a complicated financing process that sometimes prevented them from investing in high-return energy efficiency projects. "A GRF allowed us to get the wrinkles out and allowed everyone to say 'I trust this methodology,'" says Matt O'Keefe, Energy Manager at UNH.

Leverage savings into opportunity

GRFs are a great way for organizations to capitalize on the savings from energy efficiency projects in order to promote sustainability in general. For example, Dartmouth College's GRF directs 10 percent of the savings from projects into a Green Community Fund. Students, staff, and faculty can then apply for money from this fund for projects that promote sustainability on campus, whether or not they have financial paybacks.

Track performance

You cannot manage what you do not measure. A GRF creates a streamlined process for an institution to distinctly track, manage, and analyze the financial and resource savings resulting from sustainability projects. The Green Revolving Investment Tracking System (GRITS) was developed as part of The Billion Dollar Green Challenge, and collects, standardizes, and analyzes data related to GRF performance (see Section 7.3 Resources).

Seize new fundraising opportunities

Some institutions have had success with fundraising for a GRF, both from alumni and external foundations. For example, President Elizabeth Kiss and her development team at Agnes Scott College raised over $400,000 in seed capital from donors within a few months by pitching their fund's strong ROI and its potential to turn the campus into a living laboratory for sustainability.

Despite the strong case for the GRF approach, it may not be the best strategy for every institution. For example, an institution may not yet want to commit the cost savings from energy efficiency to future projects until it has verified that there are enough investment opportunities available to absorb such funding. In other cases, an institution's procedure for financing projects may be set up in a way that does not lend itself to a revolving approach. Potential GRF adopters should carefully weigh the associated pros and cons of the model to ensure that it is appropriate for them.



Lane Community College – Health & Wellness Center. Large projects funded by GRFs can generate a high volume of savings while providing a visible symbol of an institution's commitment to sustainability.

Chapter 2:

The Anatomy of a GRF

This chapter:

- Discusses key components that make up a green revolving fund strategy
- Provides a menu of options for how each fund component might work
- Discusses approaches that have been or could be used for each component
- Provides recommendations for tailoring each component to your institution

No two green revolving funds are exactly the same. While all GRFs finance measures that improve environmental performance and use the associated cost savings to finance future projects, they can differ on a wide range of parameters including structure, size, mission, management, project criteria, funding sources, payback requirements, and more.

Successful funds will be tailored to the distinct structure and culture of their home institution. Perhaps the most powerful attribute of the GRF model is that each of its components can be adapted to the unique challenges, goals, and opportunities of your institution.

2.1 Seed capital

Capital for a GRF may be obtained from a variety of funding sources, and some institutions have combined multiple sources. Potential seed funding sources are discussed below.

Operating budgets

Annual operating budgets are the most common source of GRF seed capital. This budget is often the most readily available and flexible funding source, and because the savings that GRF projects generate will often come from the operating budget, it may be seen as the most appropriate source of seed capital. An operating budget may provide a one-time infusion of capital or multiple infusions over time to scale the fund gradually.

Within operating budgets, common sources can include the facilities, sustainability, or energy budgets, as well as other departmental budgets or administrative funds. In some cases, shrewd fund proponents have been able to tap into unused or underutilized budgets to launch a GRF, thus converting poorly allocated funds into a high-return investment opportunity. For example, the University of Vermont is using a portion of their cash reserves—normally held in low-risk investments for a short time before being spent—to seed its GRF.

Endowment principal

An institution may also invest its endowment funds directly into a GRF. Given recent volatility and risk in financial markets, investing in high-return, low-risk sustainability projects on campus may present a favorable option for endowment managers. Refer to SEI's GRF *Investment Primer* for more detailed guidance (see Section 7.3 Resources).

Utility rebates and incentives

Utility companies often offer programs to large institutional customers to encourage them to reduce energy use, such as rebates, demand response, or other incentives. In exchange for conserving electricity or natural gas through upgrades and retrofits, colleges and universities are often given reduced rates or cash rebates, which they can then use to seed a GRF. Sometimes these savings then translate into even further incentives from the utility company.

Capital budgets

Institutions often have funds set aside for large capital projects such as new construction and renovations. These funds may be housed within a facilities budget, within the endowment, or as a separate budget entirely. Capital budgets are often already used to fund large energy efficiency projects, making them a logical source of seed money.

Cost savings or revenue from existing projects

A GRF can be financed from savings or revenue being generated by projects that were financed by other means. This may provide a low-risk option if decision-makers are hesitant to commit capital to a GRF without proof of actual savings from projects within the institution. For example, the savings from a lighting upgrade or revenue from the sale of renewable energy credits (RECs) from on-site solar power generation may be used to start the fund without requiring additional capital.

Students

Student sources of capital include a green fee levied on students (either mandatory or voluntary) or student government funding. If proposing a fee, it is advisable to first conduct a willingness-to-pay analysis by polling the student body to: 1) assess support for the fee, 2) determine the optimal size of the fee, and 3) estimate the revenue that the fee will generate for planning purposes.

Donations and grants

Many institutions, especially colleges and universities, have relationships with outside foundations or other donors who seek to foster research and improve programs and operations. GRFs are often appealing because of their interdisciplinary scope, ability to promote education and engagement, and environmental and economic benefits. The Jessie Ball duPont Fund recently launched the first foundation grantmaking program in the country specifically designed to help seed green revolving funds at a select group of colleges.

Some funds start with a few large alumni donors, and others are part of targeted sustainability or broader fundraising campaigns. A gift to a GRF combines the best aspects of the immediate impact of an annual fund gift with the longevity of an endowment gift. A hypothetical $100,000 contribution will provide more than $555,000 in cumulative savings to the institution over 10 years (based on the median three and a half year project repayment period reported in *Greening the Bottom Line 2012*).

Government funding

A variety of government programs exist that can be used to seed a GRF, including programs at the federal, state, and local levels. Institutions have used both American Recovery and Reinvestment Act (ARRA) grants and state energy efficiency programs to either start funds directly, or to implement projects whose savings are then used to seed a revolving fund.

Key considerations for seed capital

There is often a tradeoff between risk and reward when allocating funding to a GRF. Large capital allocations from existing sources (e.g., an endowment or capital budget) enable the fund to finance large capital-intensive projects that will produce a high volume of savings. Large funds are also more likely to become firmly established because they have more flexibility to finance projects and pay fund management expenses, but they represent the most institutional commitment. Conversely, incremental funding strategies (e.g., annual allocations from the operating budget, savings from existing projects, or an annual student fee) put fewer resources in play in case the fund encounters obstacles, but this may prevent the fund from becoming established and quickly achieving the highest cost-savings.

Many institutions have started their funds small to demonstrate effectiveness, then scaled up once the administrative structure is operational. As Rosi Kerr, Dartmouth College's Sustainability Director, noted, "I would rather start small and knock it out of the park than bite off more than we can chew initially." For example, the Harvard Green Loan Fund was capitalized with $1.5 million in 1993, and was revived and enlarged to $3 million from the central administrative budget in 2001. As a result of its consistent success, it was doubled in 2004 and again in 2006 to arrive at its current size of $12 million. However, other schools such as Macalester College have encountered problems with starting small, finding that less capital in a GRF leads to a proportionately higher administrative cost and burden on staff. Additionally, starting small may mean that the fund has less flexibility in choosing and installing projects due to capital constraints.

When deciding how to size your fund and at what rate (if any) to scale it over time, factors to consider include 1) the volume of potential projects and their ability to absorb capital, 2) your institution's tolerance for change and financial innovation, and 3) the capacity of your fund management team and facilities department to support project implementation.

2.2 Accounting systems

The accounting system is the backbone of a GRF. This component includes the accounts, stakeholders, procedures, and rules that are involved in moving GRF-related money within the institution. Accounting is often the most complex component of successful fund design, so it should be addressed early.

Accounting systems can be divided into two broad categories:

Under the **loan model**, the project applicant (e.g., department, school, campus group, etc.) actually borrows money from the fund via a budget transfer. The project owner is then responsible for repaying the loan (with or without interest, see next section) by using the savings the project produced within his or her own campus unit. In the loan model, repayment is usually determined with upfront (i.e. ex-ante) estimates of savings and is not altered to fit actual project performance. This model works best when project applicants have control over distinct operating budgets, discrete ownership of projects, and facilities staff or building technicians to assess potential improvements. Loan funds may advertise the loan as a financial product or service on campus, hoping to solicit applications from facilities and budget managers for individual units or departments.

Under the **accounting model**, funds are transferred to the project applicant, or to a central facilities department, but repayment is made via a transfer of funds back into the GRF from a centrally managed operating budget (often utilities) where the savings were generated. The project recipient typically does not have discrete ownership of the project, and in many cases is housed in the same campus unit or department as the GRF itself (e.g. office of the VP for Finance, Facilities, or Administration). This model works best when there are no autonomous entities, such as colleges or schools, within an institution,

or when those entities draw from the same central budget to either pay utilities or finance facilities projects. The GRF may be a distinct account (often with its own account number) or it may take the form of a concept or agreement (e.g., a line item on annual budgets) without maintaining a physical account balance.

Some funds incorporate elements of both accounting and loan models. For example, a GRF may be a distinct account that makes disbursements or loans to a separate facilities office account, which then uses savings to repay the GRF account. Thus the GRF makes loan agreements with another account based on utilities budget savings, but transfers are between just those two accounts rather than multiple ones. In the example, the GRF is also partly an accounting model because the fund is in operation at a campus with centralized facilities and utilities budgeting, so both the fund, the utilities budget, and facilities projects are likely managed by a few key staff (e.g., the CFO, the Facilities Director, and the Sustainability Director).

Successful funds have been developed using both models. The key lesson across all institutions is that the GRF accounting system must be tailored to work within the existing system. A GRF is not a pre-defined entity to be adopted wholesale; it is a flexible concept that can be molded to fit with your institution's current standards and practices. Experience has shown that adapting the model is crucial for smooth implementation. SEI's GRF *Investment Primer* (see Section 7.3 Resources) provides more discussion.

Case studies: Accounting systems — ISU and UVM

The following two case studies show how two institutions have established their accounting systems to fit the source of seed funding, the set of stakeholders who are managing the fund, and the existing accounting structure of the university. Iowa State University (ISU) mostly follows the classic loan model, whereas the University of Vermont's (UVM) accounting model is a hybrid involving loans from from the cash reserve fund to staff responsible for facilities projects across campus.

Iowa State University

Iowa State's Live Green Revolving Loan Fund was seeded by an allocation from the President's Office of interest from previous university investments. The revolving fund is a separate account which is managed by the Sustainability Director. Staff—often facilities or building supervisors—submit project applications directly to the fund's advisory committee. Once approved, projects are funded as reimbursement payments, rather than a lump sum payment. Repayments on each zero interest loan begin one year after completion of the project, and are due annually until the loan has been repaid. Projects with a five year estimated payback (or shorter) are targeted, although loans must be repaid within five years regardless of actual cost savings.

Iowa State University took the rare step of changing how the university billed its constituent units for utilities in order to encourage conservation and enable the creation of a revolving fund. Previously, while units still had their own separate facilities staff and building managers, the school's overall utilities budget was determined by total campus energy consumption. By assigning the utilities budgets to each specific building, Iowa State provided an incentive for building supervisors and occupants to produce unit utilities cost savings, and with the revolving fund was able to assist units in financing as well.

University of Vermont

The University of Vermont's Energy Revolving Fund is an accounting model GRF established in 2012. It was seeded with $13 million from the university's cash reserve fund, which is normally invested for short periods in low risk financial instruments. The GRF is housed within the cash reserve fund and is managed by the VP for Finance and Administration and the Director for Sustainability. They may draw from the cash reserve fund to finance efficiency projects, but these projects must pay back 5 percent interest on their outstanding loan amount each year in addition to principal repayments. Projects must repay the fund within seven years. The fund was approved by the Board of Trustees and will consult with statewide efficiency groups on project identification and planning.

When a project is approved, disbursements are made from the cash reserve fund to the campus operating budget responsible for implementation. When savings are produced from these projects, usually within the general fund utilities budget, they are then split. Interest in the amount of 5 percent of outstanding principal on the project loan is sent to an operating budget account where investment returns from the cash reserve fund normally go, referred to by UVM as the operating investment income account within the general fund revenue. The remainder is transferred as a principal payment to the revolving fund account, replenishing the cash reserve with capital to be used for future projects. To be conservative regarding savings, any increases in utility rates are not factored into the calculation of project savings. Once a project has repaid its loan to the cash reserve fund, the general fund utilities budget is adjusted accordingly and afterward savings accrue to the university instead of the revolving fund account.

2.3 Payback mechanics

The size and timing of repayments to the GRF may also be customized. For example, projects may repay only a portion of their savings to the fund each fiscal year or period. Alternately, they may be required to repay an amount greater than the original loan value, either by paying interest on outstanding loan balances or by repaying more than 100 percent of the loan value in total. In some cases, an administrative fee has been levied on projects in order to cover the fund's operating costs. Where GRFs target mainly projects that create savings in the central utilities budget, interest or a fee is sometimes charged only on loans for departments outside of the central budget such as athletic stadiums or student government-owned buildings.

There is often a tradeoff between making GRF financing attractive to funding applicants and the need to cover administrative costs or grow the fund over time. Project recipients might prefer to retain a portion of annual savings, but it will be at the expense of quickly replenishing the fund. Similarly, charging interest or requiring repayment over and above the loan value will allow the fund to grow organically without additional capital infusions, but this places a higher cost on project owners. The correct balance will depend on your institution's political environment and the goals of your fund.

2.4 Fund oversight

The set of stakeholders tapped to oversee a GRF is another key consideration that affects both the politics of the fund and its performance. There are three broad options for selecting projects and managing the operations of a GRF (the details of management are discussed in Section 2.5 Fund operations):

- **A management committee** is the most common GRF leadership model. Such a committee may be formed from a pre-existing body such as a working group, or may be formed specifically for the GRF. Stakeholder groups who will be involved with or affected by the fund (e.g. students, facility managers, faculty, administrators) should typically be represented on this committee to maintain buy-in and contribute their expertise.

- **Staff and resources from a relevant office** may be used to oversee the fund—often the finance, facilities, or sustainability office.

- **A dedicated manager** may be appointed specifically to run the fund, or fund management may be added to the job responsibilities of a current administrator.

Management by committee is often advantageous for several reasons. First, it leverages the unique breadth of expertise in a campus community. Second, it promotes engagement and awareness of the fund. Third, it promotes cross-disciplinary collaboration and innovation. Fourth, it reduces the burden that falls on any one member of the committee. If a student green fee or student government funds are used to capitalize the GRF, it is particularly important to have student representation on the fund committee. However, a smaller management team housed in a single office may offer tighter control of financing and a more streamlined process for issuing loans.

In some cases, the leadership structures highlighted above have been combined, with different groups managing different aspects of the fund. For example, a sustainability director or administrator may serve as the fund manager and coordinate the operations of the fund, with a committee (sometimes chaired by the fund manager) that selects projects and provides guidance.

2.5 Fund operations and project selection

The management of fund operations involves a broad array of duties. Many institutions create a GRF charter, an official and publicly available document that explains how the fund operates. This is particularly important when campus community members will be applying for GRF financing. Charters are often developed from a written proposal used as a forum for discussion during fund design, and may use much of the same language (see Steps 2, 4, and 7 in Chapter 3 for more discussion of proposals, charters, and other documentation).

It is important to clearly specify your fund's procedure for reviewing, evaluating, and selecting projects. Project selection may be conducted by soliciting applications from the campus community and putting them through a competitive process. Alternately, fund managers may select projects non-competitively. For example, they may compile a prioritized list of potential projects identified via an energy audit and select projects from this list. If using this approach, it is advisable to have a representative from the facilities department either on the management team or in close contact with the team in order to streamline this process. Projects may also be identified from previously existing lists such as deferred maintenance, or through research by other groups on campus.

Case study: Project selection — Arizona State University

The Sustainability Initiatives Revolving Fund (SIRF) at Arizona State University (ASU) uses a multi-tiered approach for selecting projects, with each tier corresponding to different project types that have different repayment obligations. The SIRF is a useful case study for establishing a flexible yet organized selection process that makes use of specific evaluation criteria. At the end of FY 2012, the fund had authorized $3.7 million in investments.

Project tiers

Recognizing that impactful sustainability projects vary in size, type, and payback, ASU developed a three-tiered system with different requirements for each tier:

- **Tier 1 – University Community Sustainability Micro Grants:** Small projects that promote student engagement and sustainability. No payback required. Maximum grant of $5,000.
- **Tier 2 – Fund Matching and Efficiency Loans:** Medium-scale capital improvement initiatives with matched funding from the department receiving the loan. Six year payback or less. Maximum of $500,000 per year. Savings are split 50/50 between the SIRF and loan recipient.
- **Tier 3 – Capital Expansion Loans:** Large-scale projects with significant and measurable sustainability impact. Ten year payback or less. All savings directed to the fund as repayment for the loan.

Project evaluation

The SIRF committee meets monthly if projects are being considered. It is comprised of seven people representing the facilities group, budget group, financial services, economics department faculty, university business services, and the sustainability group.

The SIRF committee uses strictly financial metrics to evaluate Tier 2 and 3 projects, provided that they meet the basic criterion of being sustainability-related. This helps build the case that sustainability is a good investment. ASU uses a hurdle rate of 6 percent (i.e. the IRR of the project must exceed 6 percent; see Section 5.1 Financial performance metrics) but prefers projects at 8 percent or more. If that baseline is met, then other financial performance metrics including simple payback, return on investment, net-present value, and annual planned repayments are considered. To be conservative, any applicable rebates are not incorporated into these calculations. Tier 1 projects are not required to meet any specific financial criteria, only to undergo a review by the sustainability group to ensure that they are consistent with fund goals.

A typical SIRF committee meeting

Before a project is discussed, a designated staff member "vets, scrubs, and pushes back on the financial analysis so that the committee is convinced it's a solid, reliable analysis and understands where the risks are," said Lisa Frace, AVP of Planning and Budget. A briefing on new projects is then distributed to committee members before the meeting for review. Committee meetings follow a typical agenda. First, members review the state of SIRF financials, including the status of current investments and remaining capital available. Second, the person requesting funding presents the project and the committee discusses. Third, the committee votes on whether to fund, reject, or request revisions to the project. If the project costs $100,000 or less, the committee has the authority to provide final approval. For larger projects, the funding request must be approved by the CFO in addition to the committee. To date, the SIRF committee has never outright denied a project, but it has sent back projects for additional analysis. Projects that do not meet the committee's review criteria do not typically make it past the vetting and analysis stage, and are withdrawn from consideration.

2.6 Project criteria

When assessing potential projects, it is helpful for fund managers to work from a specific set of project criteria. These criteria may include both hard requirements and preferred attributes. Some common project criteria include:

- Payback duration
- Capital cost
- Specific environmental benefits such as resource conservation or greenhouse gas reduction
- Cost-effectiveness metrics such as greenhouse gas reduction per dollar of capital cost
- Potential for community engagement and collaboration
- Educational benefits

Project criteria should be selected based on two factors. First, they should promote the mission of the fund. A GRF that is focused on maximizing operational efficiency might have aggressive payback requirements, whereas a fund that emphasizes community engagement might favor projects that are student-led. Second, criteria should be tailored to the actual portfolio of projects that are available for investment.

Consider incorporating flexibility in project requirements at the discretion of the fund managers. They may need to adapt as the portfolio of available projects changes over time or as unique opportunities arise. For example, a project may compensate for failing to meet financial requirements with outstanding performance in other areas such as education, engagement, or tackling deferred maintenance. In addition to specific criteria, projects should also be prioritized in a way that best allocates limited resources while accounting for the feasibility and timing of projects given other constraints, such as staff availability.

2.7 Measuring savings

The GRF model relies on capturing cost savings to replenish the fund, so the method by which those savings are measured is crucial. There are two main strategies that fund managers may use to calculate savings from projects in order to determine repayment amounts.

First, fund managers may use front-end savings estimates based on engineering analysis. This method relies on technology specifications and assumed usage patterns to predict future performance. This is the most straightforward and inexpensive approach, but it will not capture any deviations in the event that a project performs better or worse than expected.

Second, fund managers may retroactively calculate savings based on actual performance. This entails using a measurement and verification (M&V) approach to directly meter savings while accounting for conflating factors like weather and usage patterns. This approach is more accurate but also more costly and labor-intensive.

An institution may perform rigorous building energy modeling based on submetering data, or it may measure pieces of equipment individually and extrapolate for the full set of equipment installed. Another option is to conduct a less rigorous assessment of whether utility costs are decreasing over time. This will not be sufficient to calculate project repayments, but it can help verify that a project or portfolio of projects is decreasing costs broadly.

Some institutions benefit from a best of both worlds approach in which the loan approval and repayment schedule are based on estimated savings, but M&V is then performed to verify that the project is functioning according to projections. Other schools, such as the University of Denver, perform both upfront and retroactive M&V on larger projects, and use project specifications and engineering estimates for smaller ones.

GRF Anatomy in Practice: Four case studies of successful funds

School	Seed Funding	Fund Oversight	Accounting System	Project Criteria	Measuring Savings
Agnes Scott College	Alumni and foundation donors, utility savings	Sustainability Steering Committee	Accounting model	Payback critical for selection – flexible time periods	Repayments based on estimates and measured savings
California Institute of Technology 1891	Money market fund within endowment	Sustainability Director and Energy Manager; with approval from AVP of Facilities and VP of Business and Finance	Accounting model	6-year payback requirement	Repayments based on estimates and measured savings
Iowa State University	President's administrative funding	Director of Sustainability; Advised by Loan Fund Advisory Committee	Loan model	5-year payback requirement	Repayments based on estimated savings but confirmed with measurement and verification
The University of Vermont	Operating cash reserves	VP of Finance and Administration; Advised by Energy Initiatives Committee	Accounting model	7-year payback requirement; GRF returns 5 percent of its outstanding balance annually to cash reserve	Varies by project

2.8 Long-term strategy

A GRF can drive broader strategic initiatives, including Sustainability Master Plans or Climate Action Plans (CAPs). When defining your fund's long-term vision, consider two key possibilities. First, it is often effective to tie the fund to long-term goals like emissions reductions or capital improvement plans, both when building buy-in for a GRF and when operating it. This connects the fund with other initiatives and may provide a source of capital to meet campus objectives. Second, GRFs present a unique opportunity to bring campus stakeholders to the table, both as part of a management committee and as project applicants. This can create a forum for collaboration and innovation that goes beyond financing.

For example, the University of New Hampshire formed an Energy Working Group with the goal of meeting its greenhouse gas emissions reduction targets under its CAP. When the GRF was established, this group became the management committee for the fund and now uses the fund as the main financial instrument to drive progress toward CAP goals.

Matt O'Keefe, Energy Manager of UNH, notes that their GRF has turned energy efficiency projects into a consistent program rather than a series of one-off investments, which has increased interest from potential funders. "We've already leveraged the fund to participate in larger programs and receive grant money," he says. For example, a grant of $50,000 for a solar power installation might turn into $400,000 of investment over 10 years as savings revolve. "I talk about how money will be leveraged into this program, and people are a lot more interested."

"The climate issue and the challenge of making affordability and accessibility of higher education a priority—the two work together. It's not one versus the other," said Anthony Cortese, Co-Founder and Senior Fellow at Second Nature and Trustee of Tufts University and Green Mountain College. "A GRF is a way to get a serious focus on deferred maintenance at the same time that we push toward dramatically reducing the carbon footprint."

Chapter 3:

10 Steps to a Successful GRF

This chapter:

- Presents a step-by-step guide to designing, implementing, and managing a GRF
- Provides key considerations and resources for each step

This chapter provides a roadmap for designing, implementing, and managing a successful GRF. These steps will aid you in developing a fund that: 1) maintains high financial and environmental performance, 2) effectively engages key stakeholders on campus, and 3) is tailored to the unique character of your institution. While each fund development process will differ, this chapter provides a general framework that is widely applicable across institutions. Each step addresses a separate component of the GRF creation process, and they are positioned roughly in the order they should be conducted. However, the steps are often interconnected. Elements of each step may need to be addressed before or after the point at which it is listed.

Step 1: **Do your homework**

The first step in developing a successful GRF is to gain an understanding of the range of GRF models and to begin thinking about how the design of your fund can be tailored to your institution. Much work has already been done in this area, and using existing materials can cut months from the fund development process. There are two key areas in which research is crucial.

First, learn about GRFs in use at your peer institutions. Gain a basic understanding of how these funds are structured, the types of projects they typically finance, and popular variations on the GRF model in use by institutions similar to your own. Several resources have been assembled as part of The Billion Dollar Green Challenge to facilitate this, including GRF case studies as well as *Greening the Bottom Line 2012* (see also Section 7.3 Resources). A keen understanding of GRFs at peer institutions can help build the case for your fund while providing ideas for how to best adapt the model.

"Don't reinvent the wheel, talk to other universities who have made this work and assimilate those programs into a custom program that will work at your school" said John Onderdonk, Caltech's Director of Sustainability Programs.

Second, be sure to examine the elements of your own institution's operations that are relevant to a GRF. These include:

- How are utility services distributed and paid on campus? Is the entire institution run as one large unit or is the university split into smaller, autonomous departments or schools?
- How is money transferred internally? Universities often have accounts associated with each department and organization and it may be necessary to secure an account for the GRF.
- Which stakeholders contribute to decisions about facility operations and project finance? Who will need to be consulted in order to build buy-in for the fund?
- What is the current state of energy efficiency and auditing on campus? Have any studies been done to identify potential energy efficiency or sustainability projects?

Step 2: **Select your model**

Early in the fund development process, outline a tentative basic structure and mission for the fund. GRFs have many variable elements that can be adapted to the unique challenges, opportunities, and priorities of your institution. There are no established rules for how a GRF must be structured, so be on the lookout for opportunities to innovate. Chapter 2: Anatomy of a GRF provides specific guidance and decision points for each component of a GRF.

Fund design should be an iterative and interactive process. It is often helpful to begin with a concept proposal, which can serve as a point of discussion with stakeholders on campus as you seek their feedback. This may take the form of a document, presentation, or a few talking points. Engage key stakeholders with this proposal early and often, being sure to include facility and energy managers, sustainability directors, investment managers, and administrators in charge of operations and finance. Student groups and faculty can also provide valuable feedback, particularly those active in sustainability, economics, and engineering. The goal of this initial round of discussions is to identify logistical, political, and financial barriers to a GRF; develop a strategy for overcoming these barriers; lay the groundwork for building future support; and refine the structure of your proposed fund to capture opportunities at your institution.

Step 3: **Assess your opportunity and run the numbers**

In order to implement a successful GRF, it is important to first understand its investment potential at your institution. This can be done by in-house facilities staff (they may already have a wish list of projects) or by hiring a contractor to perform an energy audit. If your institution has signed on to The Billion Dollar Green Challenge, consider consulting the project library of the GRITS web tool (see Section 7.3 Resources) for examples of projects typically financed by GRFs. If the fund will solicit project applications from the campus community, it can be useful to determine in advance which projects are likely to receive financing in the first round and assess their potential performance as well.

The ideal result of this step is a pipeline of projects that the GRF will likely finance during the first few rounds of investment, including estimates of the costs and savings associated with each, and a forecast of how the portfolio of projects as a whole will perform. Forecasting the fund's expected performance over the first few years—including metrics like total savings, annual return on investment (ROI), average payback period, and net-present value (NPV)—is also helpful for building buy-in and tailoring your fund model to maximize performance. This can be done in GRITS or using custom-made spreadsheets, which can then be used for tracking once the fund is launched (see Step 9 for more information).

Step 4: **Build buy-in**

A key component of developing a successful GRF is thorough stakeholder engagement. First, determine the essential stakeholders and decision-makers whose support will be required to establish and sustain a GRF. Second, consider those stakeholders' responsibilities at the institution, the performance metrics on which they are evaluated, and how a GRF can be leveraged to help them meet their goals. Third, engage those stakeholders to refine the GRF proposal so that it is in line with the needs and goals of all parties. A written proposal (building from the concept proposal in Step 2) can be a helpful tool during this process. This document can serve as a forum for discussion and debate as the GRF concept evolves, and in many cases it can evolve into the fund charter once the proposal is approved.

Note that building buy-in and a sense of collective ownership should be a continuous process that occurs along with all of the other steps. However, it is particularly important in the early stages, in order to streamline the fund's development and ensure that no office or stakeholder is inconvenienced or left out.

Step 5: **Secure seed capital**

The process of securing seed capital can range from a straightforward allocation of available funding to a laborious multi-month process of consulting decision-makers. It is therefore advisable to begin this effort early. See Section 2.1 Seed capital for a review of each potential source of seed funding.

One key strategy is to look for underutilized capital, particularly if you are having difficulties identifying potential funding sources. Because of the high returns and low risk associated with GRF investments, such a fund is often a favorable alternative to allowing capital to go unused or be poorly used. To finance Caltech's $8 million GRF, for example, administrators taped into a money

market fund within the endowment that was largely underutilized and earning only 1-2 percent annual returns. The money now finances GRF projects which, after the projects have repaid the initial investment, generate average annual utilities cost avoidance equal to 20 percent of their upfront cost.

The size of the GRF and the amount of capital to be raised should match your fund's goals and the campus' potential for projects. Step 3 Assess your opportunity is crucial in order to determine an appropriate size for the fund.

Step 6: Establish financial flows

All stakeholders should feel comfortable with the loan and repayment process. Before any project is undertaken, involved parties must understand:

- Who pays the project invoice, which account they use, and when those funds will be available
- Which account will be making repayments over the course of the loan, how often those repayments will occur, and the total of each repayment as well as the overall repayment obligation
- How all of these flows of money will appear on the various departmental budgets and balance sheets (if multiple departments are involved)

Establishing this internal accounting procedure is the point at which many GRF proposals stall or fail entirely, often because technical details are overlooked by fund proponents, or they encounter red tape. Be sure to begin engaging on this issue early in the process. Some institutions have an independent account with its own ID number for a GRF while others simply make an agreement to acknowledge the savings of the GRF as annual budgets are distributed (see Section 2.2 Accounting systems). Look at how external purchases are made at your institution and how funds are transferred internally, then base flows of GRF payments upon these preexisting channels.

Step 7: Launch the fund

Launching the fund is an important process in and of itself, especially if your fund relies on project applications from the campus community. If your institution has joined The Billion Dollar Green Challenge, this is also a good time to reach out to The Challenge network for best practices and guidance from those with GRF management experience.

When launching a GRF, it is useful to have the first round of funding planned out. The insights from Step 3 Assess your opportunity will be useful to that end. As projects are being implemented, make sure to continue the planning process for future waves of projects or applications, as well as for fund management, outreach, and meetings of the leadership team. Planning for the future is important not only to efficiently manage the fund and ensure that its capital remains effectively invested, but also to show campus stakeholders how the fund is progressing and demonstrate success.

It is important to establish your fund in a way that fits within the campus culture and administrative structure. Specifically:

- Formalize the GRF with a fund charter, bylaws, memorandum of understanding, formal project criteria, and any other necessary guiding documents. Be sure that all relevant stakeholders are aware of these documents.
- Consider developing a website for the fund. This can provide a useful venue for informing the campus community about the fund, posting official fund documents, providing tools and resources for getting involved or proposing projects, and reporting on the fund's progress to the public.

- Consider providing office hours for inquiries about the fund. This is particularly important if you will be soliciting project applications from the campus community, as questions will arise.

Finally, when the fund is launched and the first few rounds of investment are underway, there are a few key questions to be evaluated to ensure that the fund runs smoothly. These include:

- Is the GRF identifying enough projects to utilize its capital? Where else should you look?
- Are those responsible for managing the fund communicating effectively with each other and with other stakeholders? Is enough staff time being allocated to manage the fund?
- Are stakeholder needs identified in Step 4 being met? Are these expectations reasonable in practice? If so, how can resources be directed to meet them?
- What questions are arising from stakeholders? Can resources be provided to address them?

Step 8: **Implement projects**

Implementing the initial round of projects will inevitably lead to challenges and unexpected obstacles. There may be difficulties with fund transfers and accounting, changes in maintenance plans that disrupt your expected pipeline of projects, projects that underperform once implemented, and other potential issues. See Chapter 6: Common Obstacles for specific challenges often encountered and strategies for overcoming them.

One approach to reduce these risks is a soft launch in which the first round of investment targets projects that are expected to be straightforward and are being implemented by trusted project managers. Another strategy is to begin with a manageable fund size and scale it up over time as success is demonstrated (see Section 2.1 Key considerations for seed capital).



Stanford University rebate from utility PG&E. Demand-side energy efficiency is a sustainability cornerstone in Stanford's energy solutions portfolio. Such rebates are also often used for GRF seed funding and project repayments.

Nevertheless, inform stakeholders that obstacles will likely arise, and recognize that how they are handled will set the tone for future operations. Be sure to include all relevant stakeholders in the troubleshooting process. Despite the pressure to produce successes and prove the GRF model, work through challenges slowly and carefully. Publicize successful projects to place any challenges in the context of the broader GRF program and continue to justify the use of capital for the fund.

Fund managers should be in close contact with the facility managers, engineers, or contractors who implement the projects and can therefore provide on-the-ground perspective. This will allow problems to be identified and resolved quicker. Monthly or quarterly progress reports may be useful for this purpose.

Step 9: Track, analyze, and assess performance

Once the fund is operating, tracking the performance of individual projects and the entire GRF portfolio over time is the next important step.

First, determine the method by which you will measure savings from individual projects (see Section 2.7 Measuring savings). Install any required submeters and establish baseline data before project implementation, then create a spreadsheet or use another software application such as GRITS (see Section 7.3 Resources) to manage this data over time. Thorough project tracking will involve recording the specifications of technology installed and estimating expected savings; comparing those estimates to usage rates determined early on via energy monitoring to ensure that projects are operating correctly; and then confirming savings more conclusively later on by comparing submetered data to the baseline you have established.

Note that even if you have elected to determine project repayments based on estimated savings only, conducting some measurement and verification of individual projects will help to confirm that they are operating as expected. Find a balance between what is necessary for project troubleshooting and determining payback and what is feasible given staff capacity and budget.

Second, develop a system for tracking and analyzing the overall activity of your GRF project portfolio. The GRITS tool is specifically designed for this function. Institutions also often use spreadsheets built from scratch or accounting software for this purpose. Verify that overall GRF performance is consistent with the forecasts conducted in Step 3 above. If there is a discrepancy, determine its cause. It is often helpful to conduct forecasts that are updated each year to chart a path forward for the fund and manage expectations.

It is also advisable to benchmark the performance of projects, buildings, and the fund as a whole against those of other institutions. In cases where you are underperforming, take the opportunity to identify the underlying causes and learn from peer institutions.

The Green Revolving Investment Tracking System (GRITS) is a web-based tool that SEI has developed to facilitate project tracking, analysis, and benchmarking. This may either complement or provide a substitute for spreadsheets or other tracking software. See Section 7.3 Resources for more information.

Step 10: Optimize and improve

While some of the main benefits of a GRF are stability and longevity, it must still adapt to changing conditions. Even after launching, the fund's design and management should be dynamic and adaptable. The most successful funds periodically reassess their performance and optimize accordingly. Some funds undertake a formal strategic review of their charter and governance every few years. It is important to not only address aspects of the fund that are performing poorly, but also to reassess more foundational aspects of the fund such as which stakeholders are involved, how cost savings are being measured and revolved, the fund's mission and project criteria, and how the fund interacts with broader campus initiatives and goals.

One key area for monitoring and optimization is project performance. Key questions to consider include:

- Which types of projects are performing especially well, both within your institution and among your peers? Consider using these as a model for new projects.
- Where are project applications or ideas originating and which parts of campus could be engaged further?
- Are your original project criteria still effective for guiding the fund managers' decisions? They may benefit from adjustments as opportunities are exhausted or new ones emerge.
- If the fund is performing well, could it be expanded with more capital infusions?

Leverage the data on project performance collected in Step 9 to answer these questions and adjust your fund strategy (and the associated documentation). Adjustments may include expanding or narrowing project criteria (e.g., relaxing short payback requirements as the most cost-effective projects are exhausted), pulling in new stakeholders or staff to help identify or track projects, and adjusting the fund's accounting procedures.

Chapter 4:

Measurement and Verification of Project Savings

This chapter:

- Introduces a set of methods for estimating upfront savings and conducting M&V
- Provides a framework for selecting the most effective methods
- Outlines the advantages and disadvantages of each method
- Lists key resources for further research into M&V protocols, terminology, and toolkits

This chapter describes two sets of practices that relate to assessing energy or resource savings: upfront estimation of savings and measurement and verification (M&V). Upfront estimation is a process of predicting the performance of a given project without measuring actual achieved performance. M&V refers to the process of comparing measured performance data against an adjusted baseline to confirm that expected project savings actually materialize after implementation. In addition to describing general M&V principles, this chapter also outlines the four International Performance Measurement and Verification Protocol (IPMVP®) options for conducting effective M&V. The IPMVP is a widely used protocol developed by a coalition of international organizations that outlines a framework with four basic options for conducting M&V for a given project.

As discussed in Section 2.7 Measuring savings, a fund manager may use either estimated savings (typically calculated before the project is implemented, or "ex-ante") or measured and verified savings (almost always calculated after implementation, or "ex-post") to determine repayments to a GRF.

4.1 Upfront estimation of savings

Before a project is implemented, three types of methods can be used to estimate its potential savings. This is not considered M&V because it relies on informed predictions rather than measured data. These estimates can be conducted by your institution or by external energy auditors, consultants, or contractors. Savings are compared to a baseline of consumption, which can be defined either as consumption levels in the absence of the new equipment (if the new equipment is optional) or estimated consumption if alternate, less efficient equipment were installed instead. There will typically be uncertainty associated with estimates of resources saved as well as future resource costs and therefore total cost-savings. Generally, the more accurate the method of estimating savings, the more costly and complex it will be. The right method depends on your institution's resources and needs, and it may vary based on project size and scope.

Manufacturer-provided savings estimates

First, equipment manufacturers or installers will often provide estimates of the project savings that their product is expected to achieve. These can often be found in the technical specifications of the product or in marketing materials. Such estimates provide an approximation of savings, but they are intended to be a guide and thus actual savings may vary when the equipment is installed. Manufacturer-reported savings will likely be measured under optimal conditions in a laboratory and presented in a way that will make a given product attractive to consumers. Importantly,

these manufacturer-reported savings will not account for project-specific characteristics such as building usage patterns, climate, and utility rates.

Expert assumptions

Second, savings can be estimated using equipment specifications combined with basic assumptions about the specific project. For example, many institutions use Excel-based spreadsheet tools that capture simple factors—including specifications of the equipment being replaced, past records and future estimates of equipment run times, basic data on occupancy patterns, utility rates, and other parameters—to estimate expected performance compared to a rough baseline. Some equipment vendors simplify the process of estimating savings based on equipment specifications by providing proprietary software designed around the performance of their equipment. This method is the most common approach, and it often provides an effective mix of cost to estimate savings and accuracy of that estimate.

Energy modeling

Third, a more detailed building energy modeling approach can be used. Building energy models incorporate information about changes in the parameters that affect energy use, such as building occupancy, equipment usage rates, and cyclical downtime like breaks in the school year. They can also account for ambient factors like weather patterns, seasonal variation, and regional climate. However, buildings and their energy use patterns are complex systems with dozens of relevant parameters. This approach is often costly and may be more or less accurate depending on the quality of assumptions used and the degree to which the model can be calibrated to historical data. A comprehensive building energy model can provide a high level of detail in projecting future system performance and project savings, although with potentially significant uncertainty. The use of the building energy modeling approach for estimating upfront savings is a key component of IPMVP Option D outlined below.

Like M&V itself, determining the optimal method for estimating upfront savings involves tradeoffs between cost and accuracy. Factors like the technical complexity of a given project (e.g. estimating upfront savings from lighting projects is often straightforward, whereas ventilation systems are more difficult to predict), available staff time and expertise, as well as the quality of available data will be important considerations.

4.2 Components of M&V

Overview

In the context of efficiency projects, "savings" are, by definition, the absence of use of a given resource, such as energy, water, steam, etc. Therefore, savings achieved as a result of a given project—or energy conservation measure (ECM)—cannot be directly measured. Measurement and verification quantifies achieved savings by comparing the energy or resource use that would have occurred without the implementation of an ECM (baseline energy use) to energy or resource use after the implementation of that ECM (post implementation energy use). Next, the effects of any adjustments are added or subtracted, such as expected change in operating hours or weather variability. At the most basic level, savings can be calculated using the following formula:

Achieved Savings =

(Baseline Energy Use – Post Implementation Energy Use) ± Adjustments

Energy savings are fundamentally related to two key factors: performance and usage. Performance describes how much energy is used to accomplish a specific task; usage describes how much of that task is required in a specified unit of time (e.g. operating hours per year). Performance is a technical specification that varies between types of equipment, while usage varies between facilities and operating practices and can change over time. Both factors must be understood to accurately measure and verify savings (as noted in the Federal Energy Management Program M&V Guidelines; see Section 4.5 M&V resources).

The first task in conducting successful M&V is to determine the scope of the evaluation. An M&V strategy may evaluate a single piece of equipment, an individual building system, a whole building, or a program of multiple projects across buildings. A building system refers to a particular set of equipment in a building which provides a specific function such as lighting, heating and cooling, or plumbing. In general, M&V assessments at the equipment or building system level are the most relevant to GRF projects, but building- and program-level assessments can be useful to assess the effect of GRF projects on overall consumption.

Baselining

To conduct M&V at any level, it is necessary to establish a reliable baseline against which the performance of the ECM can be assessed. Generally, a baseline is the level of energy or resource performance that would have been achieved in the absence of the ECM. There are two basic ways to construct a baseline for M&V: directly measure historical energy and resource use and other related parameters to construct a measured baseline, or use available data and assumptions entered into a software- or Excel-based simulation tool to construct a modeled baseline.

A **measured baseline** is constructed primarily from previously measured data in the specific building, system, or piece of equipment affected by the ECM. Measured baselines require some level of metering or data logging in advance of project implementation, usually one or two years. Recorded data is then averaged and extrapolated into the future, either assuming conditions remain constant or adjusting for seasonal fluctuations, occupancy, and other relevant factors. The measured baseline approach involves some costs in terms of staff time needed to record and analyze data both before the project (to establish the baseline) and after implementation (to measure achieved performance). However, measured baselines are generally considered to be more accurate than modeled baselines, given their direct connection to actual performance and the fact that they take into account the building system context in which the ECM occurs.

In contrast, a **modeled baseline** simulates a building, system, or piece of equipment under the scenario in which its performance is equal to minimum energy performance standards and requirements. The modeled baseline approach uses little or no directly measured data, and defines performance under a hypothetical reference case in which no efficiency improvements have been implemented. Modeled baselines are used almost exclusively for new construction, in cases where no historical utility data is available. The modeled baseline approach relies on a software-based simulation to construct a baseline using default calculations for energy or resource use for a given building or equipment type. These default calculations can be based on manufacturer specifications attached to installed equipment or on expert judgment. The modeled baseline approach is often used in conjunction with

the building energy modeling approach described below. The costs of this approach vary widely, depending on the cost and time-intensiveness of the specific software employed.

Verification

Once the baseline is constructed, post implementation performance data should be compared to the adjusted baseline to determine the net impact of the implemented efficiency measures. This exercise can either be performed once after project completion or on a recurring basis. Because the verification process can involve a wide range of potential project performance parameters, an upfront plan that defines how and when savings will be verified is often a key component of an effective M&V strategy.

4.3 IPMVP options

The International Performance Measurement and Verification Protocol (IPMVP®) is a widely used protocol developed by a coalition of international organizations (led by the United States Department of Energy) which is applicable across many regions and sectors. The IPMVP outlines a framework with four basic options for conducting M&V for a given project. They range from measurement of key parameters at the level of a single retrofit to comprehensive measurement or modeling at the building level. The IPMVP options are a useful starting point to frame the discussion about which M&V approach will be most effective for your institution in terms of the desired level of detail, accuracy of results, and cost. The correct choice will depend on the size and number of ECMs, the availability of historical data, and the degree to which certain parameters are expected to fluctuate. Note that a measured or modeled baseline could be used with any of these four options, though certain combinations are more common than others. While the options below are primarily concerned with measuring performance ex-post and then comparing them to baseline data to identify savings, keep in mind that the choice of an M&V option will also indicate which baselining method discussed above to choose from. The options are discussed in more detail below and presented graphically in the form of a decision tree on page 30.

Option A — Retrofit Isolation: Key Parameter Measurement

Under this option, savings are verified through measurement of key performance parameters related to an ECM's impact on the performance of a building or system. Non-essential parameters can be estimated based on historical data, manufacturer specifications, or engineering judgment provided by staff or outside consultants or contractors. Option A will provide relatively detailed savings estimates while lowering overall costs through reduced measurement and lowered staff time. A common example of Option A would be a lighting retrofit where electricity consumption is measured and hours of operation are estimated based on historical data.

Option B — Retrofit Isolation: All Parameter Measurement

The all parameter measurement approach offers a more comprehensive analysis than Option A. All energy or resource use performance parameters associated with an ECM are directly measured. Option B will increase both the accuracy and the cost of M&V. It can be particularly useful when assessing the impact of an ECM where parameters such as occupancy, equipment use time, or other factors are likely to fluctuate and are therefore difficult to estimate accurately based on historical data or default assumptions. An example of Option B would be a lighting retrofit where both electricity consumption and hours of operation are measured.

Option C — Whole Facility

Under the whole facility option, project savings are determined by measuring energy use at the building or system level. The whole facility approach reduces the cost of required metering, as energy and resource performance data is most commonly available at the building or system level. However, factors unrelated to a specific ECM that may have an impact on overall facility energy or resource use, such as weather and occupancy, must be controlled for. This approach is commonly used in cases where several ECMs have been implemented within a single building, or the effect of a given ECM is projected to be significant enough as a percentage of total energy use (often defined as greater than 10 percent) that its effects will be easily identifiable at the whole facility level.

Option D — Calibrated Simulation

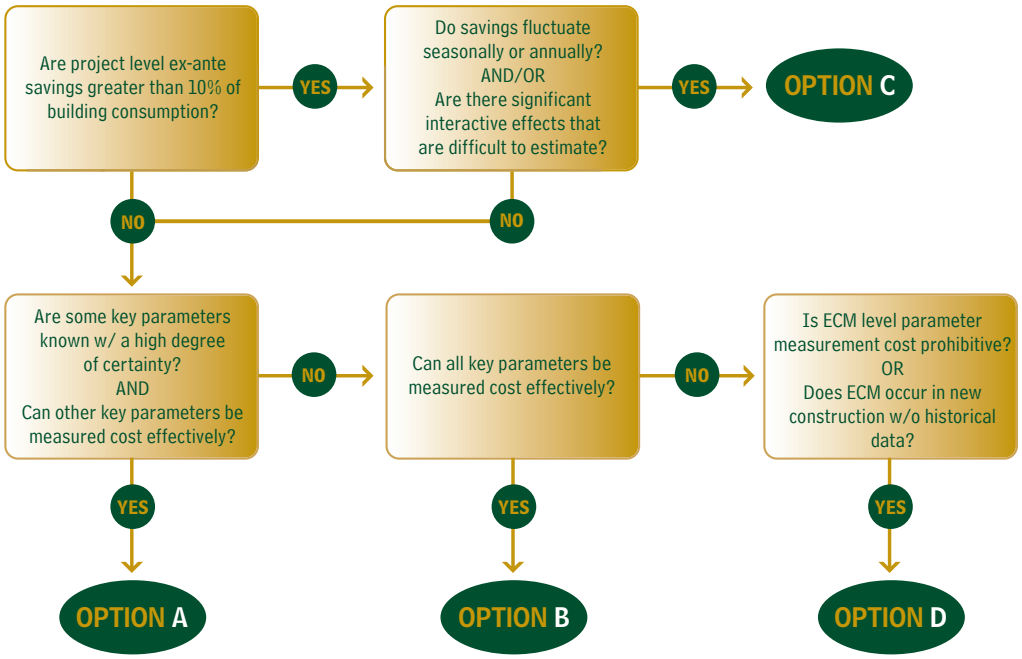
Under this option, savings are estimated through a software-driven simulation of the resource use of a whole facility, sub-facility, building system, or individual retrofit. Accurate simulation of building energy use requires a high level of technical sophistication to fully account for the entire range of dependent and independent energy performance parameters. However, this approach is becoming more common as the market for third-party energy performance assessment software becomes increasingly competitive and affordable. Some third-party contractors or consultants will provide calibrated simulation software services as part of their standard project management process.

This approach can be particularly valuable in situations where no historical energy performance data was gathered, or in determining the effect of ECMs in new construction against a hypothetical alternate building design using less efficient equipment and systems. It is distinguished from

IPMVP Decision Tree

Based on building-level ex-ante assessment

Based on ECM-level ex-ante assessment



Option C by the level of measured data available. Option C depends on metered data at the whole facility level, while Option D uses calibrated assumptions based on average or estimated values for a given building type or building system.

4.4 Understanding M&V as an investment

A common barrier to investing in efficiency is a lack of understanding about the technical- and performance-related risks associated with efficiency projects. Facility managers, administrators, and financial professionals within an institution sometimes voice skepticism about the real-world impact of a project. For example: How likely is it that projected savings will actually be achieved? How much will my department really save? If I lower costs through energy savings, how can I avoid receiving a budget cut as a result?

Conducting effective M&V on efficiency projects can help answer some of these common questions. Verification of achieved savings can provide a crucial understanding of the risks associated with a given project type and increase confidence among stakeholders within an institution, thus lowering the barriers to future investments in efficiency.

When deciding which level of M&V to pursue for a given project or program, it is important to think about what kind of data key stakeholders will require to fully understand the project's outcome. M&V activities should be calibrated to produce data that is sufficiently comprehensive and accurate enough to achieve the desired level of confidence and understanding of risk.

Moreover, once confidence in energy efficiency investments has been established among stakeholders, effective M&V can provide insight into the cost-effectiveness of each project type relative to all available options within your institution. Understanding which projects have consistently generated the highest returns can allow fund managers to optimize their investment strategies over time, prioritizing the best opportunities for investment and leading to improved financial performance. M&V also provides a useful tool for identifying and correcting underperforming equipment.

In this context, it can be useful to think of M&V as a strategic investment in the long-term financial performance and total impact of a green revolving fund. This shift in thinking mirrors the way that a GRF itself helps institutions understand efficiency projects as investments rather than a line item cost or operating expense.

4.5 M&V resources

Berkeley Lab: Measurement & Verification Portal

International Performance Measurement and Verification Protocol (IPMVP)

American Council for an Energy-Efficient Economy (ACEEE)

American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)

Federal Energy Management Program (FEMP)

End-Use Energy Efficiency Evaluation, Measurement and Verification (EM&V) Resources

Case study: Measurement and verification — Caltech

The Caltech Energy Conservation Investment Program (CECIP) features a cutting-edge M&V approach that includes upfront building energy modeling and comprehensive measurement of savings throughout each project's lifetime.

Forecasting savings

Before financing a CECIP project, Caltech conducts a thorough upfront estimation of its likely savings. Projects must have a six-year estimated payback or better to qualify for financing. Different estimation methods are used depending on the complexity of the project.

For simple projects like lighting upgrades, Caltech uses spreadsheets to estimate savings based on the specifications of the technology and basic assumptions about usage rates. The local utility has provided a lighting inventory spreadsheet for this purpose, which Caltech fills out. The utility then reviews the completed spreadsheet to provide third-party verification and to calculate applicable rebates. To be conservative, rebates are considered "bonus" savings and not counted toward the payback requirement.

For more complex projects like HVAC upgrades or whole-building retrofits, Caltech uses a building energy modeling tool to estimate savings. They create a model that is calibrated to within 3 percent accuracy of metered baseline consumption before the upgrade. The model is then used to forecast project savings at the application stage.

Metering

To provide for both ex-ante modeling and ex-post M&V, every project financed by CECIP must have building submeters associated with it. If no meters exist, the cost of installing them is rolled into the project cost. Caltech has a rolling metering plan that attempts to proactively install meters in advance of projects, which are usually planned and prioritized three years ahead of when they will be funded. In some cases, however, meters must be reactively installed just before project implementation. Caltech may then either delay the project to collect sufficient baseline data to perform M&V, or it may conduct active performance testing (e.g. by turning new systems on and off while measuring consumption) once the project is complete.

Measuring achieved savings

Caltech uses a thorough M&V approach to track savings once a project has been implemented. Every quarter, Caltech performs a whole-building M&V exercise on completed CECIP projects in which current usage is assessed against baseline usage while controlling for weather, occupancy patterns, and other conflating factors to determine savings. These measured savings are then compared to forecasted savings, and the most conservative (i.e. lowest) savings number is used to determine the project's repayment obligation to the fund each quarter. For lighting upgrades, Caltech annually spot-measures the panels on which lights have been replaced and performs statistical sampling using data loggers to verify the energy reduction. Once a year, Caltech goes through a "true up" process to adjust savings estimates to account for new utility rates for gas and electricity.

Key takeaway

Caltech has found that this integrated approach to modeling, metering, and measuring is a powerful way to justify CECIP projects and structure repayments. While upfront energy modeling is often seen as cumbersome and costly, Caltech has found it to be indispensable. They also reinforce that metering is useful not only for fund repayments but also for tracking performance and identifying underperforming building systems in general.

Chapter 5:

Fund Analytics

This chapter:

- Explains key financial and environmental metrics used to forecast, track, and report on the performance of GRF projects
- Provides guidance for analyzing GRF portfolio performance

Quantitative metrics provide an important tool for managing and improving a GRF (see Step 9 Track, analyze, and assess performance in Chapter 3). This chapter examines common metrics and explains how they can be used, both to analyze individual projects as well as to examine the entire portfolio of projects financed by a GRF. Note that many of these metrics may be calculated either 1) ex-ante to forecast performance and help fund managers assess potential projects or 2) ex-post to track and report on historical performance. The GRITS tool (see Section 7.3 Resources) automatically calculates each of the financial and environmental performance metrics discussed here.

5.1 Financial performance metrics

Payback period

Description: One of the simplest and most common metrics for calculating project financial performance is simple payback period. It refers to the number of years (or sometimes months) required for a project to recoup its original capital and installation cost with the savings it generates. Payback period is expressed as:

$$\textit{Payback period (years)} = \frac{\textit{Upfront cost of project (\$)}}{\textit{Annual project savings (\$/year)}}$$

Use: Payback period provides a quick method for comparing the financial viability of different projects and is often used as a criterion for project selection. In 2012, 34 out of 76 institutions specified a maximum payback period for GRF projects. These range from a limit of two years to ten years with an average of six years (see *Greening the Bottom Line 2012*).

Pros and Cons: Payback period is an easy-to-understand metric that can be explained to non-technical audiences. However, it is a fairly crude measure of financial performance, as it does not account for the cost of capital and cannot be directly compared to metrics that track investment performance on an annual or monthly basis. Payback period also does not capture the total volume of savings achieved (e.g. a $10,000 project with savings of $5,000/year in savings would have the same payback period as a $1 million project with $500,000/year in savings).

Return on investment

Description: Return on investment (ROI) refers to the savings a project generates as a percentage of its upfront cost. ROI may be calculated for the entire lifetime of the project or on an annual basis:

$$\textit{Lifetime ROI (\%)} = \frac{\textit{Total project savings(\$) - Total cost of project(\$)}}{\textit{Total cost of project (\$)}} \text{X100}$$

$$\textit{Annual ROI (\% / year)} = \frac{\textit{Annual savings (\$/year)}}{\textit{Upfront cost of project (\$)}} \text{X100}$$

Use: Annual ROI can be expressed for a single year or as an average across multiple years, such as average ROI to date or average expected ROI over the project's lifetime. Furthermore, average or median annual ROI across multiple projects is often publicly reported as a GRF performance metric. Though ROI is closely related to payback period, it is not as frequently used as an explicit criterion for project selection. Note that lifetime ROI and annual ROI are usually defined differently (as they have been here). Lifetime ROI represents net savings (i.e. total savings less total cost) as a percentage of total cost. Annual ROI is typically expressed as gross annual savings as a percentage of upfront cost, without subtracting upfront cost from savings. Therefore, the commonly used term "annual ROI" is more correctly called "rate of return" or "annual yield."

Pros and Cons: ROI is a useful metric to assess the savings from a project relative to its cost but, like payback period, it does not capture the total volume of savings. Annual ROI can be more easily compared to investments with annual returns such as stocks and bonds, though they are not precisely equivalent because GRF investment returns are non-compounding and the original investment (typically in equipment) is often illiquid.

Net-present value

Description: Net-present value (NPV) refers to the total net savings of a project while accounting for the time-value of money. It represents the profitability of a project in dollar terms after applying a discount rate to future costs and savings. NPV is expressed as:

$$\textit{NPV (\$)} = \sum_{t=O}^{N} \frac{\textit{Savings in year t (\$) - Cost in year t (\$)}}{(1+i)^{t}}$$

Use: A key attribute of NPV is that is devalues (i.e. discounts) costs and savings depending on how far into the future they occur. This reflects that fact that a dollar saved in the future is worth less than a dollar saved today, because a dollar saved today could be invested elsewhere and would be worth more than a dollar in the future. NPV also takes into account the total number of years the project will be active. For example, a project that costs $100,000 and saves $300,000 total over three years would have a higher NPV than an identical project that saves the same amount over five years.

The discount rate used to devalue future costs and savings is a key variable in NPV calculations. Discount rate represents the opportunity cost of capital (i.e. the returns that capital could generate if invested elsewhere). It may also be increased to reflect risk or uncertainty that savings will actually materialize in the future due to unpredictable factors. Based on an informal survey of stakeholders, higher education institutions often use a discount rate in the 5-10 percent range for GRF investments.

NPV is typically only used for ex-ante calculations, since its purpose is to devalue the future. Note that for a project that occurred entirely in the past, NPV will be equivalent to net savings because costs and savings in the past are not discounted.

Pros and Cons: NPV is powerful in that it captures many relevant factors omitted by other metrics—including project lifetime, the time-value of money, and total volume of net savings. This makes NPV one of the most comprehensive metrics for comparing potential projects within an institution. However, NPV is unintuitive for non-technical audiences and often hinges on the somewhat arbitrary selection of a discount rate.

Internal rate of return

Description: Internal rate of return (IRR) is defined as the discount rate at which a project's NPV would be zero. In other words, IRR is the breakeven rate: the discount rate at which the present value of future savings equals the initial investment. It represents the profitability of a project in the presence of discounting, expressed as an annual rate of return.

Use: Projects with a higher IRR will generally be preferable to those with a lower IRR. Therefore, IRR is often used to compare prospective investments. IRR is also useful in weighing a proposal against a "hurdle rate"—the rate of return required for an investment to be considered profitable. The hurdle rate is set based on the riskiness of the project and the opportunity cost of capital. It is often identical to the discount rate, though it may take into account project-specific factors that an institution's overall discount rate does not. If the IRR exceeds the hurdle rate, the project is considered a good investment.

Pros and Cons: Like NPV, IRR incorporates information missed by other metrics. IRR is a more nuanced metric than annual ROI because it incorporates the time-value of money as well as information about when costs and savings actually occur in the project's lifetime. However, IRR does not capture the total volume of savings achieved and can be difficult for non-technical audiences.

Example case study: Financial performance metrics applied

This case study illustrates how the financial performance metrics discussed above might be used to compare two hypothetical projects that are candidates for GRF funding. See below for hypothetical performance data.

Sample Project: Financial Performance Metrics

	LIGHTING	BOILER
TOTAL COST	$100,000	$150,000
TOTAL SAVINGS	$265,000	$305,000
YEAR 1	$20,000	$50,000
YEAR 2	$20,000	$45,000
YEAR 3	$20,000	$40,000
YEAR 4	$20,000	$35,000
YEAR 5	$20,000	$30,000
YEAR 6	$30,000	$25,000
YEAR 7	$30,000	$20,000
YEAR 8	$35,000	$20,000
YEAR 9	$35,000	$20,000
YEAR 10	$35,000	$20,000

PAYBACK PERIOD	5	4.43
LIFETIME ROI	165%	103%
AVERAGE ANNUAL ROI	27%	20%
NPV	$73,301	$74,359
IRR	19.7%	20.2%

The first project is a lighting upgrade that is estimated to cost $100,000 upfront and save a total of $265,000 in electricity bills over a 10-year lifetime. The second is a boiler retrofit that is estimated to cost $150,000 and save $305,000 over a 10-year lifetime. In this example, the GRF has only $150,000 available to invest, so the fund managers must select one of the two projects.

The two projects have similar payback periods, but they have very different cash flow projections over time. The lighting project begins saving $20,000 per year, but because the price of electricity is projected to rise in this hypothetical example, the project is expected to save more money later in its lifetime. Conversely, the boiler upgrade begins with high savings, but declining natural gas prices and reduced occupancy in the building where it is installed are expected to drive down savings over time.

If we look exclusively at payback period and ROI, the lighting upgrade appears to be the clear choice. While lighting will take six months longer to pay back, it will generate 62 percent more return on investment over its 10-year lifetime. Even on a year-by-year basis, it will have a 7 percent higher average ROI than the boiler upgrade—which means the institution will receive more savings each year per dollar invested. The boiler upgrade will generate more total savings over its lifetime but less total savings per dollar invested.

However, when discounting is factored in, this analysis changes. Using a 7.5 percent discount rate (typical for universities) the NPV of the boiler upgrade is slightly higher than lighting. This reflects the fact that most of the boiler upgrade's savings occur in the near future, whereas most of the lighting upgrade's savings don't materialize until electricity prices increase further into the future. Therefore, discounting the future has a greater impact on the present value of the lighting upgrade. However, if the institution were to use a 5 percent discount rate instead of 7.5 percent, this effect would be reduced and the lighting upgrade would take the lead with a higher NPV. Note also that the IRR for the boiler upgrade is greater than that of the lighting upgrade because a higher discount rate would be required to drive its NPV to zero.

The decision of which project to finance would depend on the management committee's preference. If the committee is not particularly confident in its discount rate and wants to maximize non-discounted savings per dollar invested, it may elect to finance the lighting upgrade. If instead the committee is confident that the discount rate accurately reflects the opportunity cost of capital and risk, or if they want to minimize the payback period, they may choose the boiler upgrade. In a case like this, they may also compare other benefits such as greenhouse gas mitigation or student engagement as a "tie breaker" in making a decision.

5.2 Environmental performance metrics

Resource savings

Description: Resource savings is a straightforward metric for measuring the environmental benefits of a project. It refers to the total amount of electricity, fuel, water, waste, or other materials that are conserved or in some cases produced by the project.

Use: Resource savings are often reported directly as a GRF performance metric. Savings of multiple types of resources (e.g. electricity and natural gas) may be converted into a standard unit (e.g. British Thermal Units, or BTUs) for easy comparison. To make resource savings more intuitive, they are often reported as equivalencies to familiar activities. For example, "this lighting upgrade saves enough electricity every year to power 100 U.S. households."

Resource savings can also be assessed against "per square foot" intensity metrics such as energy intensity (BTU/SF) or water intensity (gallons/SF), which are often used in sustainability goal-setting.

For example, if a lighting project reduces the electricity consumption in several buildings, its effect on electricity intensity could then be calculated—either for the buildings in question or for the campus as a whole.

Greenhouse gas mitigation

Description: Greenhouse gas (GHG) mitigation refers to a project's reduction of emissions that include carbon dioxide, methane, nitrous oxide, and other gases that warm the climate. This metric takes into account the amount of resources saved, the GHG emissions intensity of those resources (i.e. per unit emissions factor), and the potency of the GHGs in question (i.e. global warming potential, or GWP).

Emissions are often reported as pounds or metric tons (mt) of carbon dioxide equivalents (CO_2e). Emissions are divided into three groups: Scope 1 emissions are directly emitted from combustion or other activities on campus, Scope 2 emissions result from utility purchases, and Scope 3 emissions indirectly result from campus activities (e.g. employee commuting or contracted waste disposal).

Greenhouse gas emissions reduction can be expressed as:

GHG Emissions Reduction ($mtCO_2e$) =
Resource Savings (unit) × Emissions Factor (mt gas/unit) × GWP (mt CO_2e/mt gas)

where "unit" is the native unit of resource savings (e.g. kWh, BTU, gallons) and "mt gas" is metric tons of a specific GHG (e.g. CO_2, CH_4, N_2O). Note that if the project reduces emissions of multiple GHGs, this calculation must be repeated for each gas and the resulting emissions reduction from each (in $mtCO_2e$) then added up.

Use: Many colleges and universities have set GHG mitigation goals as part of the American College and University Presidents' Climate Commitment (ACUPCC) or as an independent objective. A key part of planning for a mitigation goal and reporting progress toward that goal is determining the GHG reduction attributable to individual projects. This is particularly important for GRFs that have the stated goal of reducing emissions or that use emissions mitigation as a project selection criterion.

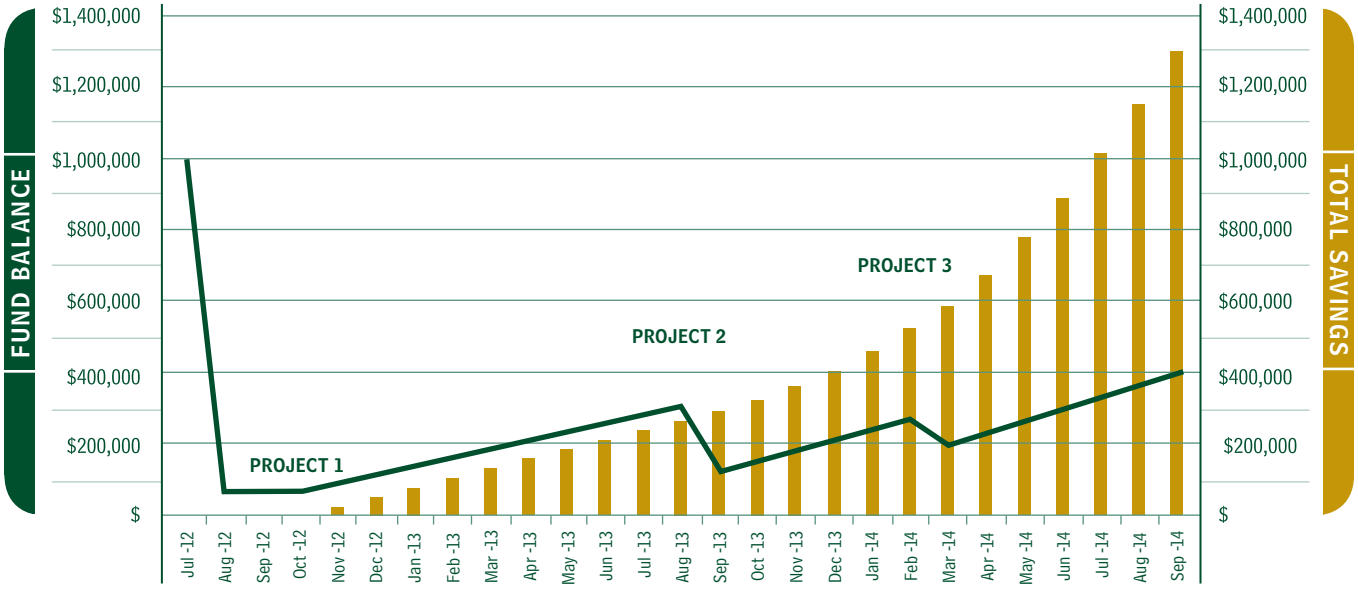
5.3 Project portfolio analysis

Forecasting and tracking the performance of the entire portfolio of GRF projects is part of a successful fund management strategy. This analysis can be used to build the case for the fund before and after it is established, report out to stakeholders on the fund's progress, and tailor fund management to maximize performance. See the Sample GRF Portfolio Analysis figure for an example of how fund performance can be visually represented.

The most basic portfolio performance metrics simply aggregate metrics for individual projects. Many funds report on the average annual ROI or average payback period across all projects in the portfolio. Median is often used instead of average to limit the effect of high or low outliers. Reporting total dollars invested, total or annual savings accrued, and total or annual greenhouse gas emissions mitigated is also very common.

However, these metrics only tell part of the story; it is also informative to track trends in some metrics over time. One key milestone is the breakeven point—i.e. the year or month in which total returns from GRF-funded projects equal the original capital placed into the GRF. The time between establishing the fund and reaching the breakeven point can be thought of as the payback period for the fund as a whole. It may also be useful to compare the GRF to traditional one-time capital investments to illustrate the benefits of the revolving mechanism. For example, consider a hypothetical fund that finances projects with an average payback of three years and revolves 100 percent of the savings until each project is fully repaid. With an initial capital allocation of $1 million, the fund could finance $2.8 million worth of upgrades within the first five years as savings from earlier projects revolve to finance later projects.

Sample GRF Portfolio Performance Analysis:
Fund balance and total institutional cost-savings over time



This graphic demonstrates how total capital available to the GRF and cost-savings generated by GRF investments can be modeled over time. Such a graph is useful for forecasting future performance, illustrating historical data, or a combination of the two.

Conducting an ex-ante GRF portfolio analysis also allows you to understand how the structure of the fund influences performance metrics, informing smarter fund design. For example, consider two potential fund designs, each of which will start with $1 million in capital. Fund #1 requires projects to revolve 100 percent of annual savings until 120 percent of the initial project cost is repaid. Fund #2 requires only 90 percent of annual savings to be revolved until 100 percent of the initial cost is repaid. Both of these funds will finance one hypothetical project type that costs $600,000, saves $200,000 per year, and has a 20-year lifetime. In this forecast, let us assume that each fund will finance another instance of this project as soon as $600,000 becomes available via revolved savings from previous projects.

When we model out each fund (not shown), we see that small differences in repayment mechanics lead to large differences in performance over time. Fund #1 will finance nine projects costing $5.4 million in the first 10 years of operation. These projects will save a total of $36 million (non-discounted) over their lifetime. Fund #2 will only finance five projects costing $3 million in the first decade, and these projects will save a total of $20 million over their lifetime. This is because Fund #1 replenishes its capital at a faster rate and grows organically over time due to the interest it charges to projects. However, this analysis does not necessarily imply that Fund #1 is superior.

Fund #2 offers the benefit that projects are cash-flow positive for the funding recipient (who gets to keep 10 percent of the savings right away) and has a 20 percent lower overall repayment requirement, freeing up project savings for other uses more quickly. These results could also change dramatically depending on the planned project portfolio, the order in which projects are implemented, the application of a discount rate, and other factors. Therefore, modeling the performance of a GRF under different sets of assumptions is key to selecting a fund design that maximizes the metrics that are important to your institution.

Chapter 6:

Common Obstacles to GRF Implementation

This chapter:

- Identifies common obstacles in the design, implementation, and management of a GRF
- Provides best practices for overcoming these obstacles based on insights from GRF leaders

A wide range of factors will determine which obstacles your institution faces in implementing a GRF. This chapter includes some of the most common challenges encountered by GRF proponents.

6.1 Financial obstacles

1. Limited sources of seed funding

This is perhaps the most common obstacle faced by institutions seeking to establish a GRF. It is also one of the first issues encountered during the fund proposal process. There are several common sources of GRF seed funding, which are summarized in the Anatomy of a GRF chapter above.

Consider starting small to demonstrate success with initial projects, then scaling up the GRF at a rate that will be more palatable to stakeholders. Some institutions even seed their GRFs from the savings generated by an initial project or set of projects conducted previously. It is often worthwhile to explore multiple existing budgets (e.g. operating budgets, capital improvement funds that have already been appropriated) if new funds are difficult to obtain. Consider contacting SEI for a list of nearby schools who have started GRFs or efficiency investments, as they may have utilized regional opportunities such as utility incentives or state grants. Throughout this process, it is helpful to remind stakeholders that the return on investment provided by GRF projects is larger and more consistent than most alternative investments (see the What is a GRF? chapter for specifics).

2. Cutting operating budgets as a result of improved efficiency

While the ultimate goal of energy efficiency projects is to reduce operating expenses, cutting operating budgets immediately can create practical and political obstacles. Many facility managers face an "efficiency budget cut paradox" in which they are disincentivized to improve building efficiency because, if they cut costs, their operating budget will simply be reduced accordingly the next fiscal year. The GRF model tackles this problem directly by freezing utilities or operating budgets during the repayment period of the project, ensuring that facility managers see the benefit of, or at least are not penalized for, achieving savings through efficiency projects. The model can also help to address this issue by facilitating the careful tracking and management of savings resulting from projects. By tracking savings explicitly, stakeholders can negotiate when and by how much operating budgets will be cut in response to those savings.

A GRF also presents opportunities to precisely direct the flow of money within an institution. For example, a portion of the savings from GRF projects may be allocated to a separate account earmarked for specific purposes. Another option is to require only a certain

portion of savings to be repaid into the fund, allowing the project owner to immediately receive some of the financial benefit even while the full project cost is more slowly being repaid. Finally, a GRF helps to restore the incentive to conserve by formalizing project savings and revolving them back into the fund, which can then be tapped by the same stakeholders for future projects.

3. Difficulties in integrating the fund with the current accounting system

Creating the accounting architecture for a GRF is a complex but critical step. If you encounter difficulties integrating your fund with current accounting procedures, here are a few points to consider:

- Financial professionals, such as the CFO, account managers, and business and finance staff, have a unique understanding of an institution's accounting system. Be sure to involve these professionals early in the fund design process and continue to seek their feedback, as their buy-in and expertise will be crucial.

- Remember that "GRF" is a flexible term, and such a fund can be structured in many different ways. GRFs range from a distinct account that issues loans (e.g., Harvard) to a simple agreement among budget managers that savings will be revolved as a line-item on budgets each year (e.g., UNH). Build a model that works within your existing accounting structure, or (as administrators did at Iowa State University) consider changing how utilities are tracked and paid, both to facilitate the GRF and incentivize efficiency and conservation on campus. Be willing to change how your fund handles repayment, project tracking, and even savings estimation to accommodate existing accounting structures and feedback from the staff who handle GRF account transfers.

- Consult with financial experts at other institutions, either through The Challenge or by reaching out on your own. Also consider seeking the advice of SEI or other consultants.

6.2 Administrative and political obstacles

1. Paying for fund staff time and management

Success can create its own administrative problems as the fund grows and evolves. These may include the challenge of finding permanent staff time to devote to fund management and conducting due diligence on proposed projects.

Fund managers often struggle to find the funds necessary to cover these costs. One solution is to ensure that loan repayment terms capture enough revenue each year to sustainably administer the fund. For established funds, consider tapping operations budgets, president's funds, or even internal or external grants to fund staff and administrative costs while not burdening loan recipients.

Instituting an administrative fee from the outset can help manage expectations and prevent resistance later on. One strategy is to wrap the money a fee would generate into the repayment terms (i.e. asking loan recipients to pay back more than 100 percent of the loan value from generated savings, such as through an additional payment at the end of the repayment term) to reduce the political pushback associated with a "fee." Also remember that there are many customization options available for payback mechanics (see Section 2.3) that can be adjusted to balance administrative needs, long-term goals, and stakeholder buy-in.

2. Securing executive and board support

For many fund proponents, convincing top-level decision-makers to consider a GRF is the largest and most important barrier to success. Though the information needed by these leaders to make a decision will vary, there are a few key arguments often cited by successful fund implementers:

First, build the business case. Cite examples of the high financial returns of energy efficiency on your campus or at other institutions. Also identify some projects your fund is likely to finance and forecast the fund's expected performance in detail (see Step 3 in Chapter 3).

Second, provide case studies to illustrate how GRFs have performed at similar institutions. While decision-makers want to be innovative, they often require reassurance that the model you are proposing has been tested elsewhere. See Section 7.3 Resources for useful materials.

"For me, it was critical that our GRF linked up with these broader themes of what kind of college and learning community we aspire to be," said Elizabeth Kiss, President of Agnes Scott College. "The most powerful teaching you do is by being a role model."

Third, connect the fund to the educational mission and priorities of your institution. As Elizabeth Kiss, President of Agnes Scott College, explains: "For me, it was critical that our GRF linked up with these broader themes of what kind of college and learning community we aspire to be. The most powerful teaching you do is by being a role model. If we want our students to contribute to building a more sustainable world, what better way than to be on that journey of discovery ourselves? So while I worried whether we had the right mechanisms in place at the outset to track the savings in a rigorous way, I realized that figuring out what we needed to do would be a powerful learning experience for us and for our students too."

Fourth, show how a GRF is an opportunity to promote a forward-thinking outlook at your institution. Anthony Cortese notes that the "biggest challenge of trying to create any revolving loan fund is to get people out of the mindset of traditional investment. It is hard to get Trustees and others to understand that this is a form of investment where you are investing in yourself." Highlight that a GRF helps overcome the perspective that views efficiency and sustainability projects as costs rather than investments. This mindset can impose real limitations not only on an institution's cost-saving potential, but on its ability to seize the long-term benefits of programs with short-term costs.

3. Internal loans are counted as debt within your institution

Some institutions may have internal accounting rules preventing or limiting debt that departments are allowed to accrue, even if that debt is internal. Restrictions may reference the "debt ratio," the portion of assets that are provided via debt. Solutions to this problem will depend on your institution's specific rules and the needs of loan recipients. First, it may be possible to reclassify GRF financing so that it is not treated as debt. For example, the disbursements from the fund could be treated as a source of revenue that can offset a debt line item of equal size, and project repayments could be classified as shared savings rather than debt repayment. Second, special exemption could be obtained by modifying existing rules to allow for the GRF, with the understanding that GRF financing is unlike traditional debt (e.g. penalties for default, if any, can be set by the fund managers) and will be administered internally.

6.3 Technical obstacles

1. Concerns about accurately measuring savings

Administrators or loan recipients may fear that they will not be able to accurately measure and verify actual savings after a project has been implemented. This is a common concern, especially when project savings are relatively small compared to total energy use, creating the possibility that actual savings will be obscured by changes in utility prices, usage patterns, weather, or other conflating factors.

There are several strategies that can be used to overcome this obstacle, and more detail is provided in the chapter on Measurement and Verification.

- Conduct an upfront audit or engineering assessment to forecast savings potential over the project's lifetime, demonstrating the short- and long-term value of the loan to the recipient.

- Conduct M&V of project savings using an agreed-upon process, providing data which verifies that the level of achieved savings is consistent with repayment terms. Create a repayment structure that adjust to changes in savings beyond the original estimates (e.g. a significant drop in utility prices or an especially cold winter).

- Consult resources such as GRITS to confirm the typical savings generated by similar projects at other institutions, increasing buy-in by demonstrating past success.

- Design conservative repayment terms that build in a buffer to account for performance variability. For example, if the project is forecast to save 30 percent of energy costs each year, agree to a 25 percent annual repayment plan. If the project performs slightly less well than forecasted, there is a buffer to cushion the blow. If the loan outperforms, the recipient keeps more total savings over the repayment period.

Remember, it is possible for utility bills to rise in absolute terms even after an efficiency upgrade has been made, usually as a result of utility prices, occupancy, or weather-related changes. It is important for fund managers to clearly explain that efficiency upgrades are still yielding benefits in this scenario, as the increase would have been larger without the investment.

2. Concerns over exhausting high-payback low-hanging fruit projects

Some institutions, especially those that have already invested heavily in energy efficiency, may be concerned about having enough projects with sufficiently short payback periods to replenish a GRF. These concerns are valid but can often be addressed by 1) looking at the experience of other "veteran" GRFs, 2) bundling projects of various payback lengths, and 3) examining the value of higher-hanging fruit such as deep retrofits and renewable energy installations. Each of these ideas is discussed below.

Experience of veteran GRFs

Some institutions have been investing in energy efficiency for decades. In many cases, rather than running out of cost-effective projects, these institutions continue to find new investment opportunities. For example, the University of Vermont launched its GRF in 2012 (the largest in North America at $13 million) after an already decades-long history of pursuing efficiency retrofits. Fund managers at UVM report that as the low-hanging fruit is picked, identification of new opportunities is driven by changing technology, rising costs of energy, and more strategic energy auditing. Western Michigan University started the nation's first GRF in higher education in 1980. Performance figures for the fund indicate that between 1996 and 2012, after already being in operation for 16 years, the fund's average annual ROI for all projects was 47 percent. Harvard's Green Loan Fund has also maintained a 29.9 percent median ROI across 192 projects financed over more than a decade.

These experiences highlight some strategies for maintaining a selection of low-hanging fruit projects throughout the fund's lifetime. First, keep abreast of changes in technology in areas like lighting, cogeneration, and renewable energy, which are rapidly evolving and continuing to produce new cost-effective technologies that your GRF may explore. Second, conduct ongoing energy auditing to assess new opportunities on campus. Improve your auditing coverage over time, both in terms of square footage and systems (e.g., HVAC and steam plant, electricity and lighting, building envelope, and retro-commissioning and building controls). Consider revisiting old project ideas every few years as the economics may have changed due to utility price increases, technological advancement, occupancy changes, or other factors. Third, consider using the high returns of low-hanging fruit to fund investments in the GRF's long-term performance such as comprehensive auditing, hiring energy management staff, and granular metering.

Project bundling

One of the most common strategies to access higher-hanging fruit projects is through bundling, where an application to the fund is composed of multiple constituent projects with a range of payback periods. This allows projects with short payback periods to directly support those with longer paybacks. The average payback period of the bundle (total cost divided by total annual savings) is below the fund's criterion, and all projects are funded and implemented around the same time. Bundling can also be accomplished by developing a list of projects for a particular building to be conducted concurrently. Simultaneous and comprehensive ECM implementation often has the added benefits of greater holistic savings, lower costs, and reduced building downtime.

Even if a GRF does not split savings or bundle projects, the savings from initial investments in low-hanging fruit projects can be used to grow the fund over time. This will allow the fund to invest in more capital-intensive high-hanging fruit projects later in its life, allowing shorter payback projects to indirectly support longer ones. A larger balance will also allow the fund to invest in multiple projects at once, which can help to stagger repayments so that savings return to the fund at regular intervals.

Re-examining high-hanging fruit

A final strategy is to recognize the value of higher-hanging fruit opportunities such as deep efficiency retrofits or renewable energy installations which are typically more capital-intensive and have longer payback periods. However, they tend to produce higher-volume savings and are often replicable across broad swaths of an institution's operations. Despite higher costs and longer paybacks, the high volume of savings and longevity of these improvements can actually result in a larger total return on investment over the life of the project. This creates an opportunity for deep reductions in greenhouse gas emissions, which can be critical in meeting aggressive sustainability or carbon neutrality goals. If low-hanging fruit grows scarce, consider adjusting the goals and criteria of the GRF so that it can begin to capture this new class of project opportunities.

Chapter 7:

The Billion Dollar Green Challenge

7.1 Overview

Launched by the Sustainable Endowments Institute in 2011, The Billion Dollar Green Challenge encourages colleges and other nonprofit institutions to reach a collective total of $1 billion dollars of investments in self-managed GRFs that finance energy efficiency improvements. Participating institutions will achieve reductions in operating expenses and greenhouse gas emissions, while having developed a regenerating fund for future projects. To help create and guide The Challenge, SEI assembled a diverse group of advisors and partner organizations. For a complete list of advisors, partners, and funders please see www.greenbillion.org/about/.

7.2 Signing on

In order to join The Billion Dollar Green Challenge, an institution must commit to the following:

1 Establish and maintain a fund that reaches $1 million or the equivalent of 1 percent of the institution's endowment (whichever is smaller) within four to six years.

2 Revolve at least 50 percent of the cost savings generated by funded projects until the project loan is repaid.

3 Become part of The Challenge network and agree to engage with other institutions, sharing data and best practices.

There is flexibility in the requirements for signing on. For institutions with smaller endowments, consider the option to invest 1 percent instead of $1 million. Also note that you need not have a fully operational fund; you need only commit to developing one. Institutions should consider joining The Challenge early in the fund development process. Many of the resources and networking opportunities it offers are useful during fund design and implementation as well as management. For more information on how to get involved with The Billion Dollar Green Challenge, see www.greenbillion.org.

7.3 Resources

This Implementation Guide is part of a suite of resources that have been created as part of The Billion Dollar Green Challenge. More information on the resources listed below is available at: www.greenbillion.org/resources

Case studies

SEI has published case studies of GRFs at nine colleges and universities.

Investment Primer

This document is designed for senior financial officers and trustees and answers critical financial questions most often raised when considering development of a GRF.

Greening the Bottom Line

This report is a survey of North American GRFs in higher education, versions of which were published in 2011 and 2012. The report summarizes and analyzes GRF-related data on fund structure, fund performance, projects financed, and more.

GRITS

The Green Revolving Investment Tracking System (GRITS) was designed to manage every aspect of an institution's green revolving fund, including aggregate and project-specific financial, energy, and carbon data.

Networks and consultancies

The Challenge provides access to a dedicated network of peer institutions that are actively pursuing the GRF approach and can share data, insights, and best practices. Whether it is VPs of Finance discussing the viability of payback models, or Facilities Managers sharing tips for project implementation, The Challenge helps professionals learn from each other's experiences and avoid reinventing the wheel. Several private consultancies also offer services to support GRF development, including ICF International (the principal authors of this Guide), AtSite, Cadmus Group, and GreenerU. Their service offerings cover opportunity assessment, fund design, fund deployment, project implementation, and measurement and verification.

Sample documents

Examples of fund proposals, charters, performance forecasts, and other documentation are publicly available on the SEI website. A more comprehensive list of non-public sample documents are available upon joining The Challenge.

List of revolving funds

The Association for the Advancement of Sustainability in Higher Education (AASHE) maintains a list of revolving funds at higher education institutions, including a brief description of each fund. The resource is available to anyone at an AASHE member institution.



Furman University. Collaboration on GRF projects creates opportunities for education and engagement, both within a campus community and across the broader sector of higher education and beyond.

7.4 Next steps

The trend toward green revolving funds in higher education appears to be picking up speed. With 85 percent of funds established since 2008 and committed capital now exceeding $100 million across all known GRFs in higher education, revolving sustainability finance is a rapidly evolving field. At the same time, the GRF approach has already begun to expand to new sectors, including healthcare institutions, K-12 schools, and municipalities. The model also has potential to expand into private companies, governments at all levels, and beyond. Our hope is that this Guide will provide a useful tool for navigating this changing landscape. With smart implementation that takes advantage of emerging best practices, GRFs can continue to capture financial and environmental benefits, engage and educate campus communities, and build the business case for sustainability.

Authors & Acknowledgements

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