Saving Energy and Money with Green Revolving Funds

CRSES Seminar
Stellenbosch University
@ Sustainability Institute, Lynedoch

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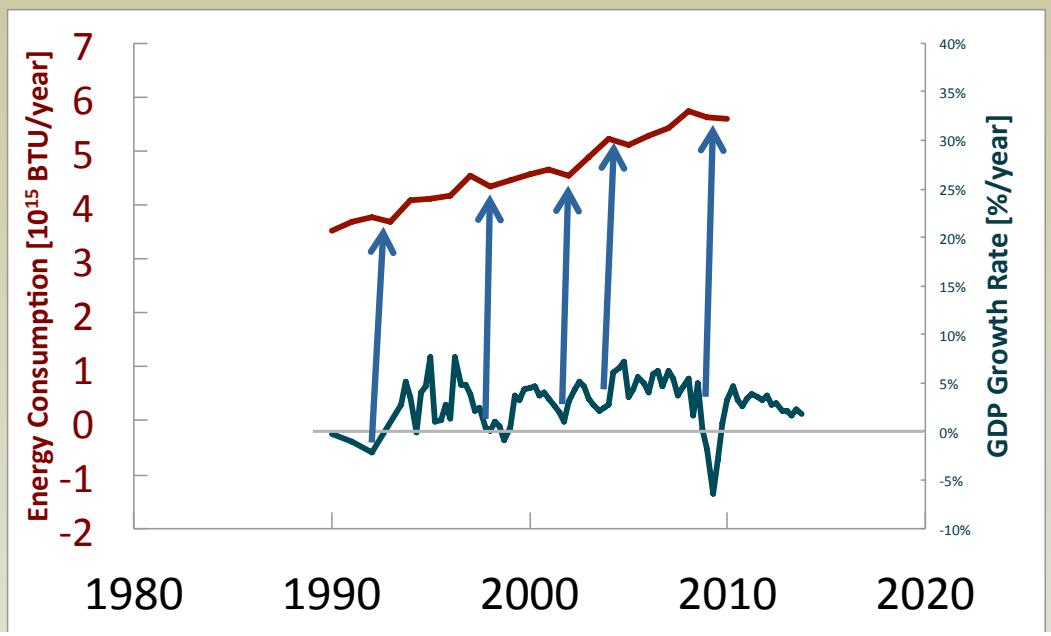
15h00, 23 May 2014

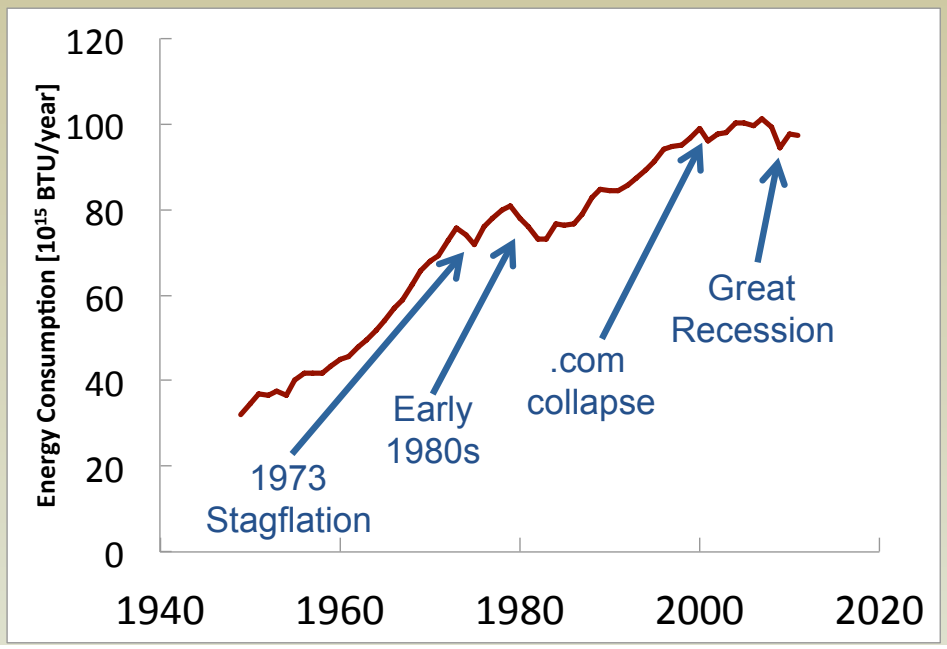
What is surest way to reduce energy consumption?

Have a recession!

ZA Energy Consumption



US Energy Consumption



Challenges to Energy Efficiency (EE)

- High capital cost
- Organizational boundaries
- Energy savings “lost”

Capability Trap

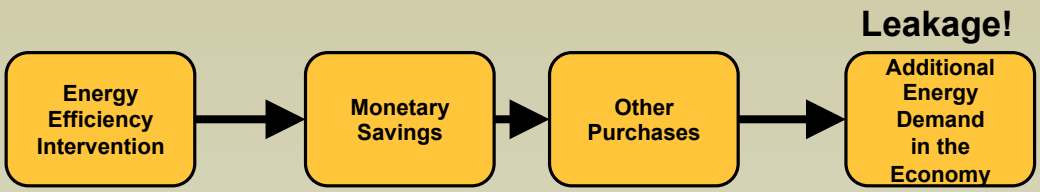
- Organizations lack slack
- EE adds to existing workload
- EE benefits consumed by cost cutting
- Long payback times (5 years is too long)

- Therefore, EE not pursued

- Therefore, EE capabilities are not developed

http://jsterman.scripts.mit.edu/docs/Sterman%20Stumbling%20towards%20Sustainability%20131111.pdf

Rebound Effect

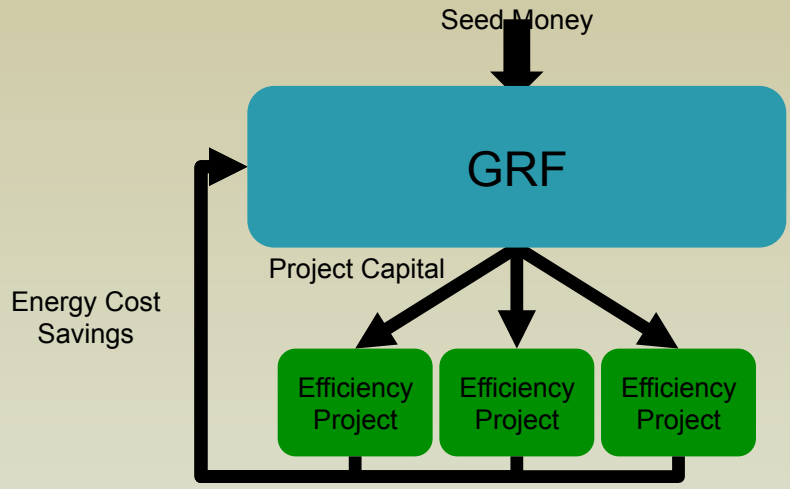


Unintended consequence:
Save less energy than you thought!

Green Revolving Funds Provide

- Funding mechanism for EE
- Centralization of EE activities
- Tracking and publicity for EE
- A way to avoid the “Capability Trap”
- A possible way around the rebound effect

Green Revolving Funds



Calvin College

Where in the World is Calvin College?

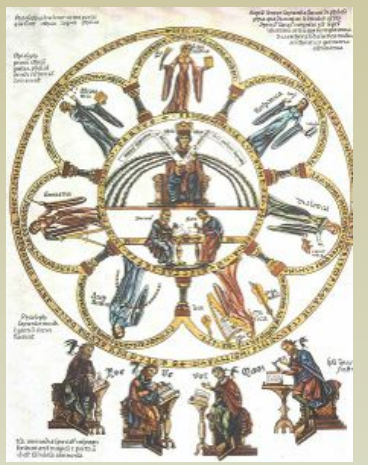
Institutional Context

- Comprehensive **Liberal Arts** institution
- Founded in 1876 by Dutch Calvinist immigrants
- 4000 students
- ENGR Dept.

- Phys. Plant (Facilities)

Liberal Arts Context

"**Big questions** are the lifeblood of liberal arts education with its emphasis ... [o]n the **connections** between the disciplines. Liberal arts education, at its best, goes beyond simply **knowing** ... and acquiring **competence** in some field."
(Curry, Heffner, and Joldersma, 2007)

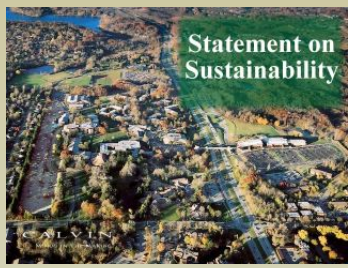


http://en.wikipedia.org/wiki/Image:Septem-artes-liberales_Herrad-von-Landsbert_Hortus-delicaiarum_1180.jpg

What would it take…?

Statement on Sustainability

Goal: “To raise the level of environmental and sustainability discussions in the campus community.”



Teaching
Purchasing and Admin. Services
Solid Waste Reduction & Recycling
Energy Purchasing
Water & Wastewater
Hazardous Materials
Transportation

Food & Food Serv.
Grounds & Land Use
Building Construction
Site Planning
Investment Policies
Outreach

CALVIN
College

Calvin Sustainability Scorecard

April 2014

Solid Waste and Recycling

Waste

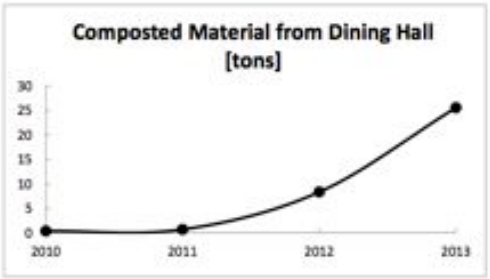
"Establish a waste reduction ethic in all areas."

"Seek to recycle at least 50% of campus waste stream."

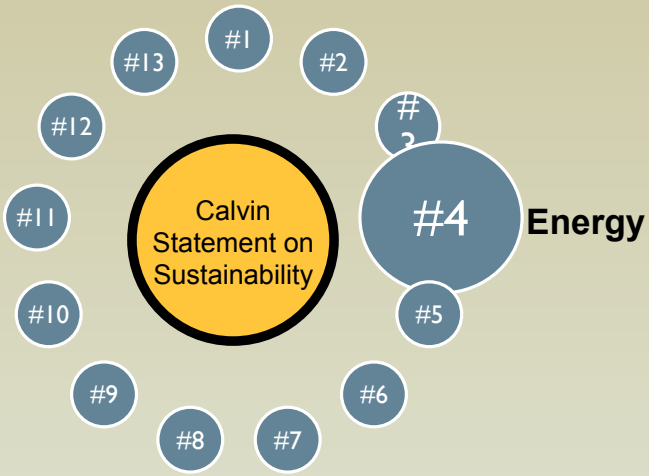
Solid Waste Reduction and Recycling 3

Calvin College continues its efforts to recycle as much material as possible. Currently we recycle office paper, paperboard, corrugated cardboard, books, glass, metal and plastic food and beverage containers, electronic devices, lamps and ballasts, batteries, polystyrene, scrap metal, concrete, used oil, and antifreeze. Composted waste diverted from the trash stream has dramatically increased due to a full year's implementation of a dining hall composting program that started midway through 2012. Additionally, incinerated and landfilled material have decreased due, in part, to the end of construction activities.

Notes about the data: Data are collected in terms of both volume (e.g., 5-gallon pails of batteries) and mass (e.g., tons of cardboard). For this scorecard, all volume data is converted to mass using measured density values. Accurate values for 2008 could not be recorded due to a change in reporting periods. The following graphs contain data reported in both academic and calendar years. Data for academic years are represented by the fall semester year i.e. 2009-2010 data are plotted in 2009.



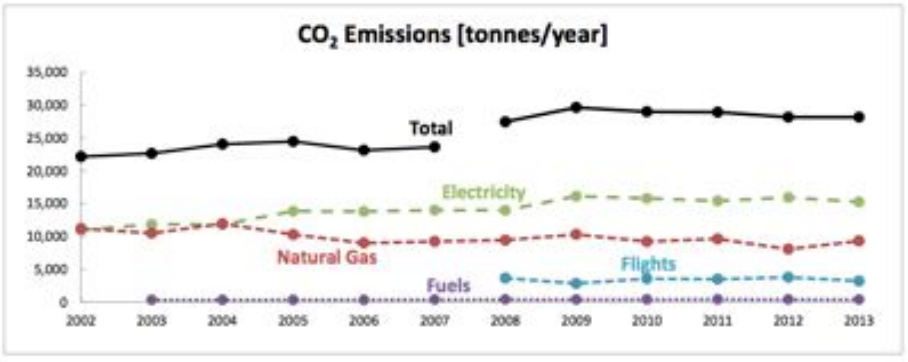
Energy

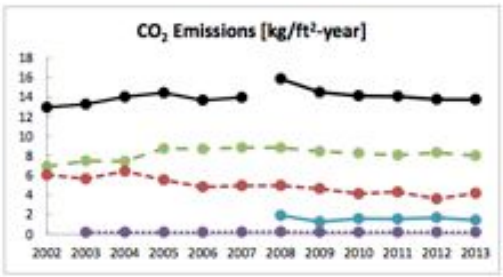


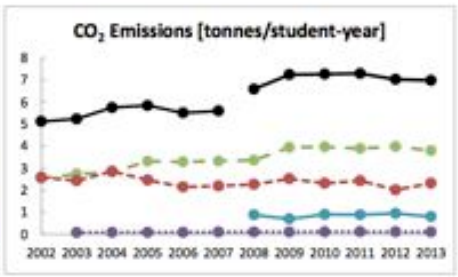
"We continually investigate new technologies for ***improved energy systems*** and ***more efficient use of energy resources***."

"Promote linkage between ***energy conservation*** efforts and programs to ***reduce carbon dioxide emissions*** and contributions to global warming."

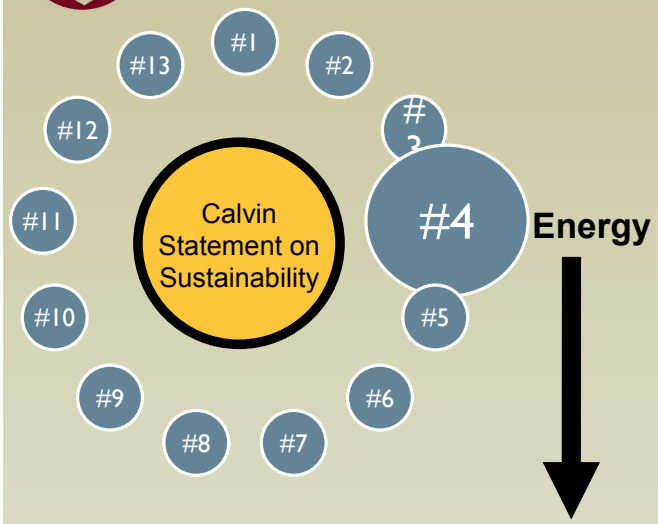
4 Energy Purchasing







Energy Efficiency



Energy

"We continually investigate new technologies for *improved energy systems* and *more efficient use of energy resources*."

"Promote linkage between *energy conservation* efforts and programs to *reduce carbon dioxide emissions* and contributions to global warming."

Calvin Energy Recovery Fund

Calvin Energy Recovery Fund (CERF)

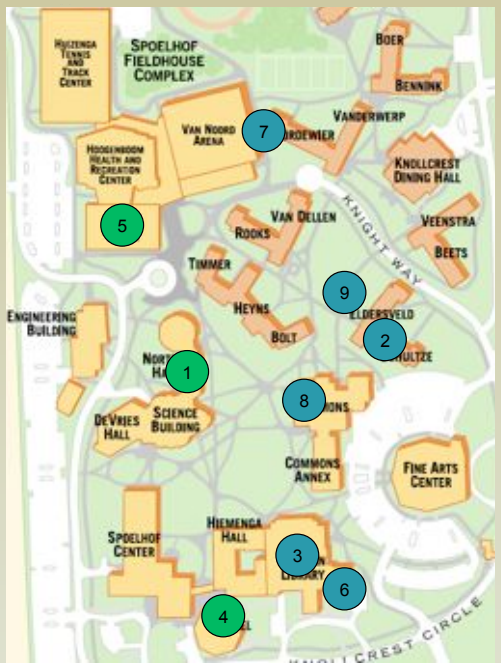
GRF Feasibility Project

- "What would it take to implement a Green Revolving Fund at Calvin College?"
- Evaluated 9 potential energy efficiency projects
- Developed fund governance policies
- Projected fund balance

ENGR333
Fall 2008

Potential Projects

CERF Project Analysis



Tech Group 1
- 1 Light Replacement
- 2 Motion Sensors
- 3 Light Harvesting

Tech Group 2
- 4 Chapel Airlock
- 5 Solar Water Heating
- 6 Forced Computer Shutdown

Tech Group 3
- 7 Dorm Heating Tunnel
- 8 CDH Windows
- 9 Dorm Hall Lights

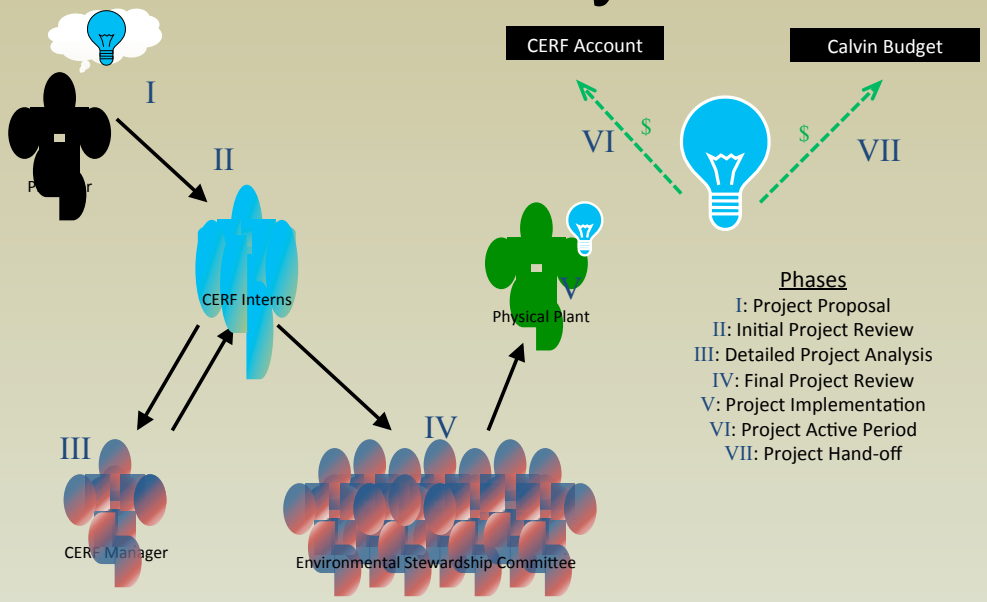
Tech Group 2 Analysis Results

	Project Location	Energy Savings	1st Year Cost Savings [$]	Upfront Costs [$]	Payback Period [yr]
4	**Chapel** – Chapel Airlock	1640 [therms/yr] (+20%/-50)	$1 400	$18 000 (±15%)	**11**
5	**Fieldhouse** – Solar Water Heating	98 800 [therms/yr] (±10%)	$81 800	$3 530 000 (+5%/-20%)	**26**
6	**All Campus** – Forced Computer Shutdown	348 600 [kWh/yr] (±7%)	$30 300	$20 600 (±10%)	**0**

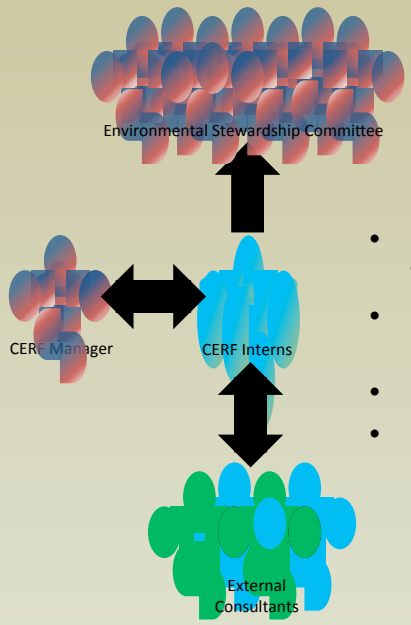
Note: All $ amounts are in 2008 values.

Policies

CERF Project Life Cycle



CERF Governance



- Final project approval
- Allocates finances
- Members from finance and physical plant
- 1 meeting/month

- Manages interns
- 2 hrs/week

- Solicit project suggestions from the community
- Research and assess EE projects
- Updates and proposals to ESC
- 10 hours/week

- Advise CERF intern and CERF Manager
- ~1–2 hours/year

CERF Project Types

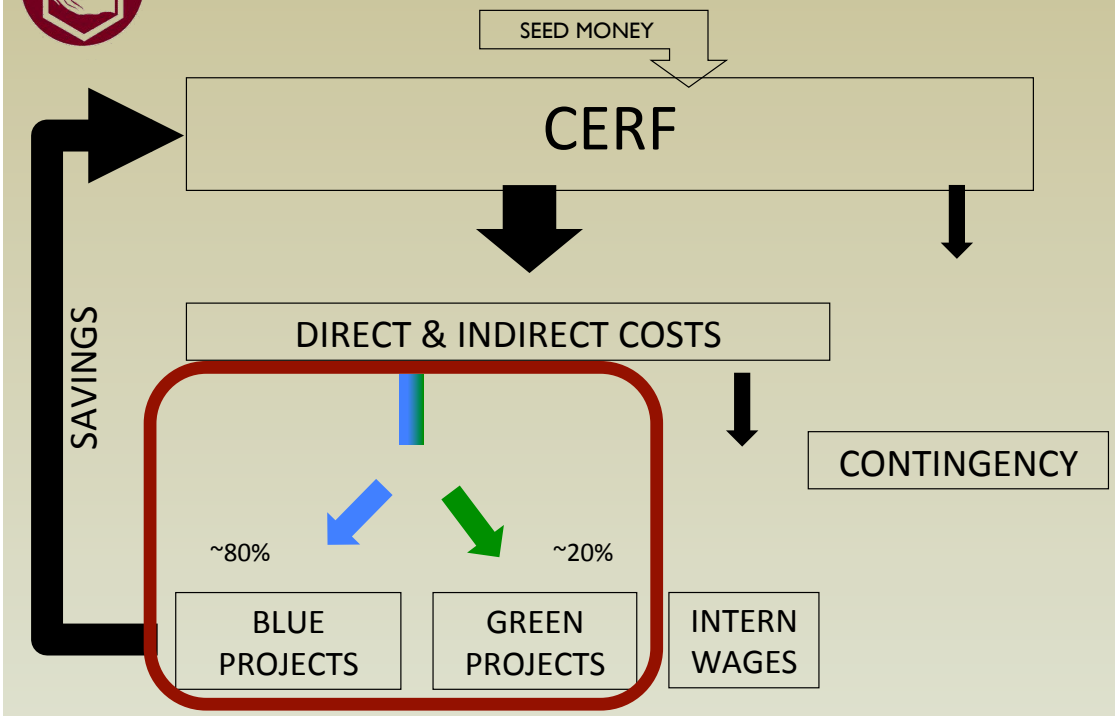
Blue Projects

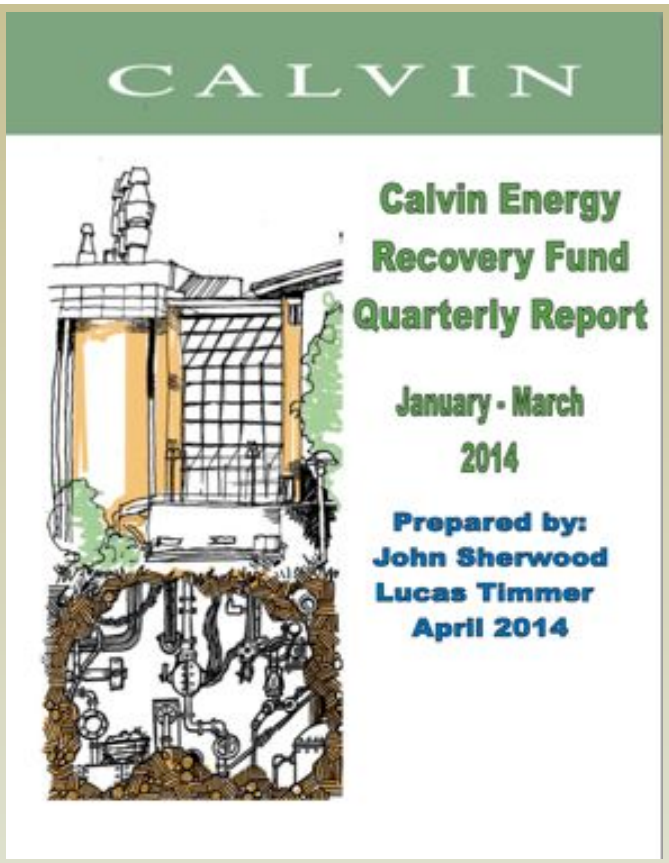
- Save energy and reduce CO_2 emissions
- Short-term financial payback (≤ 5 years)

Green Projects

- Save energy and reduce CO_2 emissions
- May not be financially viable
- Raise awareness for sustainability and renewable energy

CERF Allocation





Finances

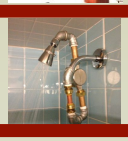
Projects to Date

Computer shutdown

Science Building bathroom lighting retrofit

North Hall lighting retrofit

Meeter Center lighting retrofit



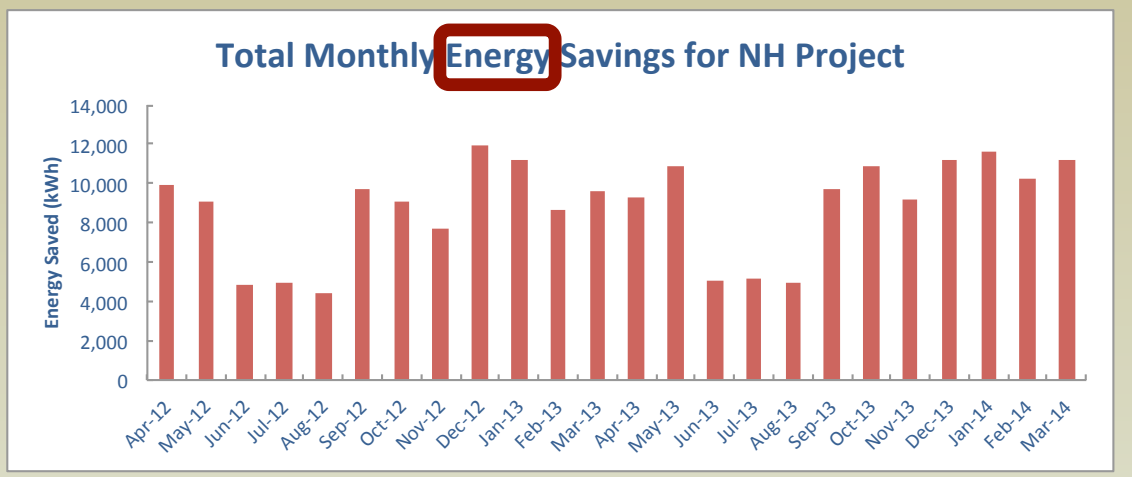
Low flow showers

Track & Tennis LED lighting retrofit

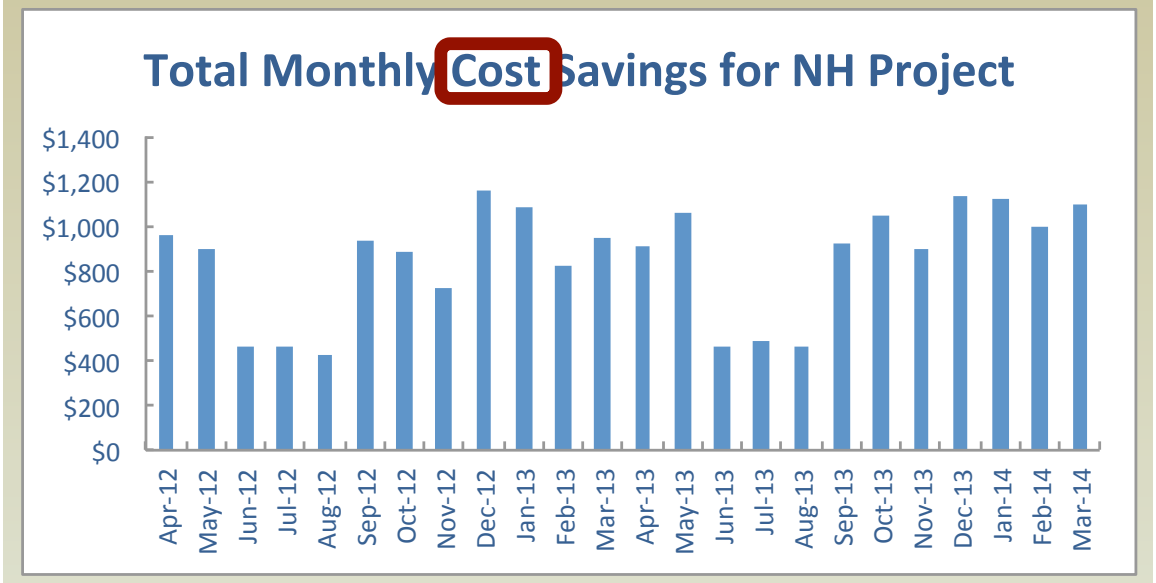
North Hall Lighting Retrofit

North Hall Lighting

North Hall Lighting



North Hall Lighting

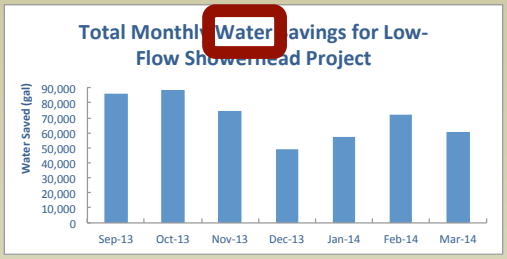


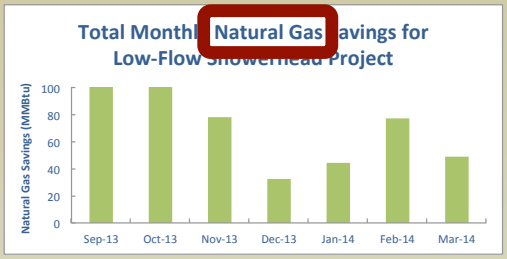
North Hall Finances

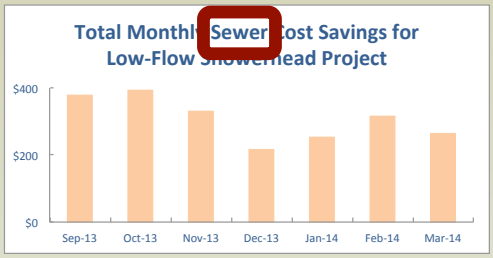
- Initial cost: $57 234
- Rebate: $10 446
- Savings rate: $11 104/year
- Payback time: 4.2 years

Shower Retrofit

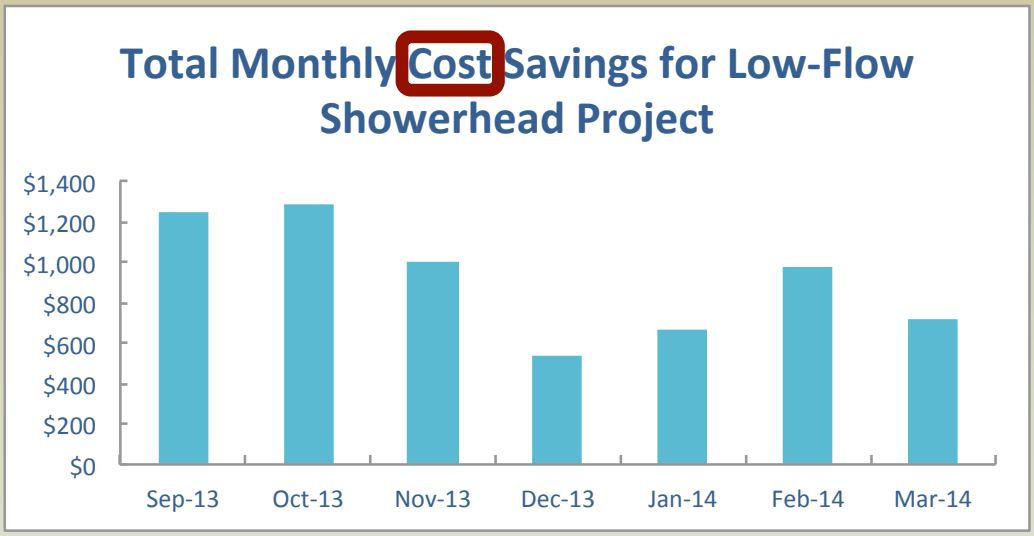
Components of Shower Retrofit Savings







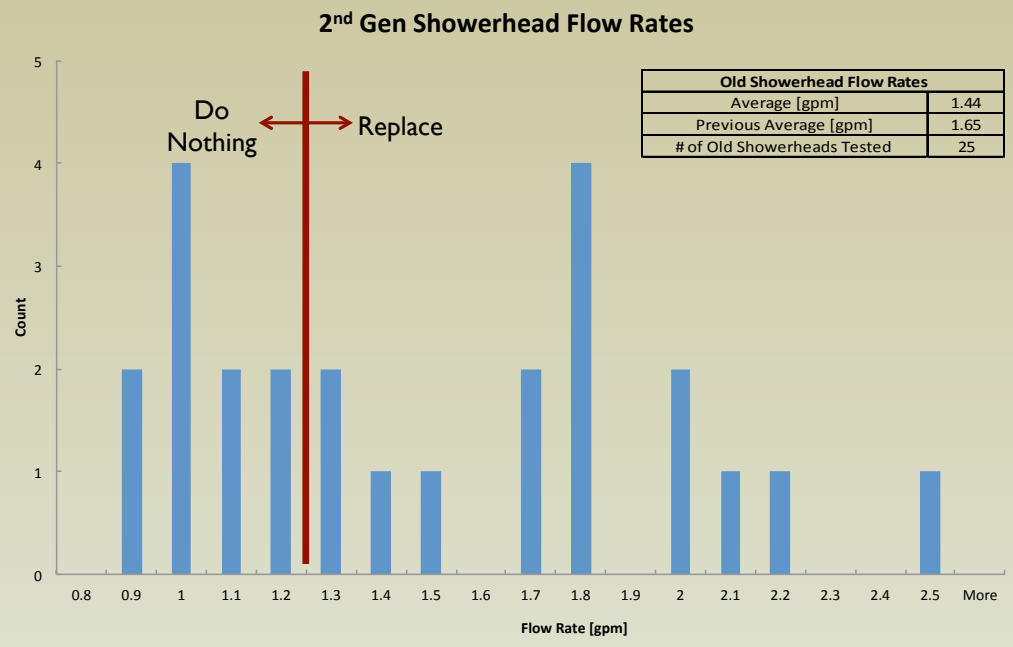
Shower Retrofit



Shower Finances

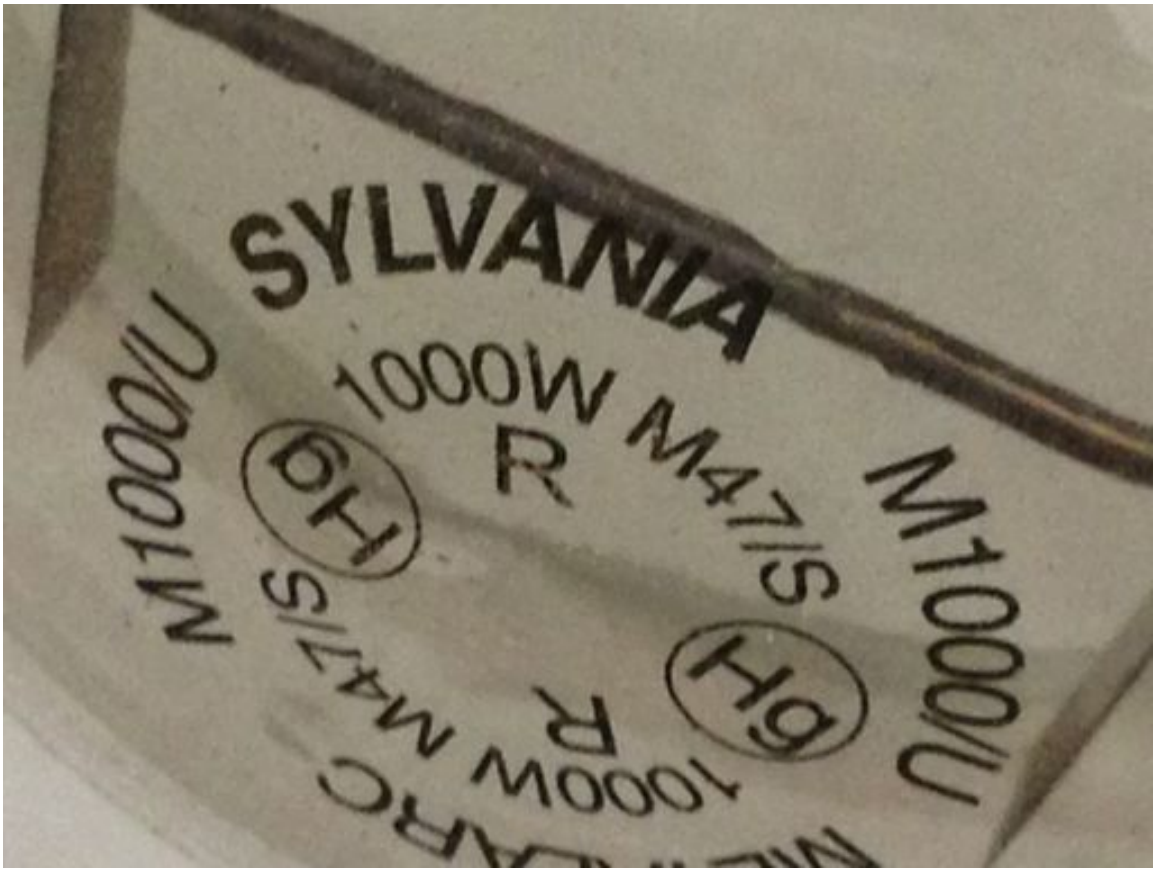
- Initial cost: $2 295
- Rebate: none
- Savings rate: $7 750/yr
- Payback time: 0.3 years

Project Extension

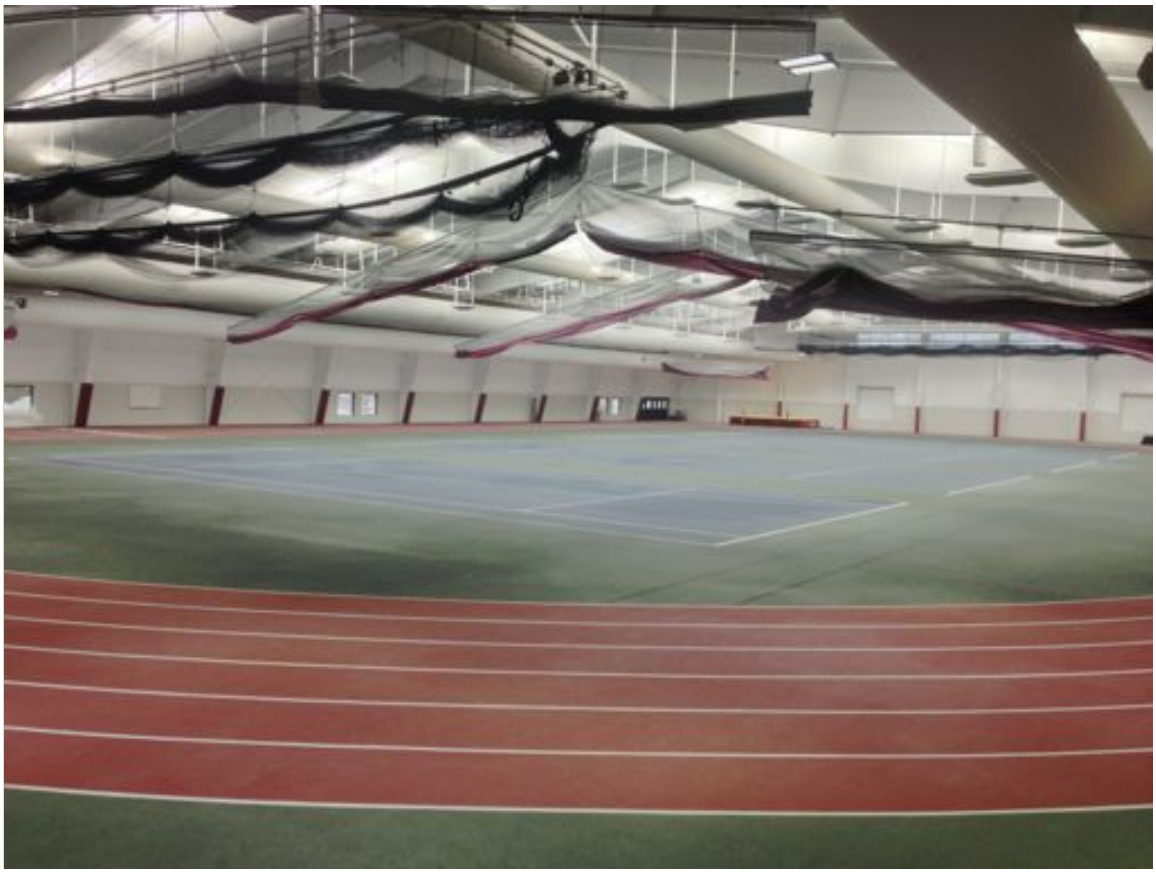


Huizenga Track and Tennis Center

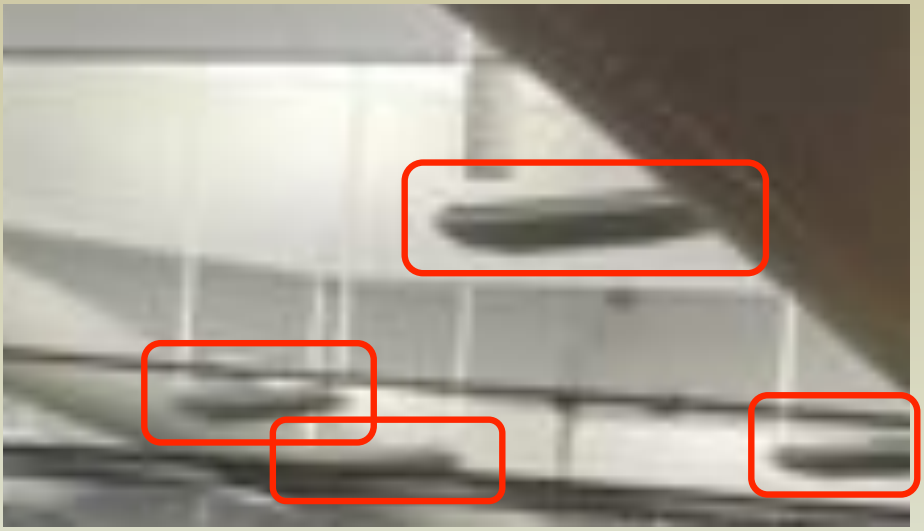
142 Metal Halide Lamps



New LED Fixtures

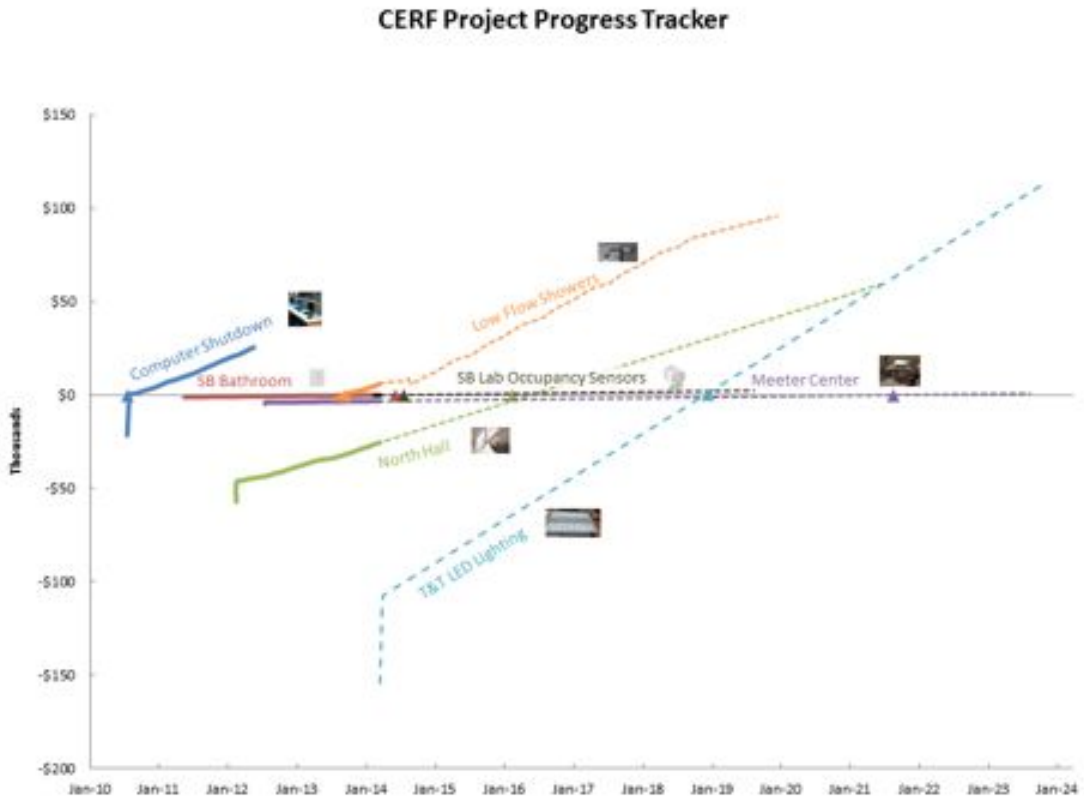


New LED Fixtures



T&T Finances

- Initial cost: $154 240
- Rebate: $46 176
- Savings rate: $23 000/year
- Payback time: 4.7 years



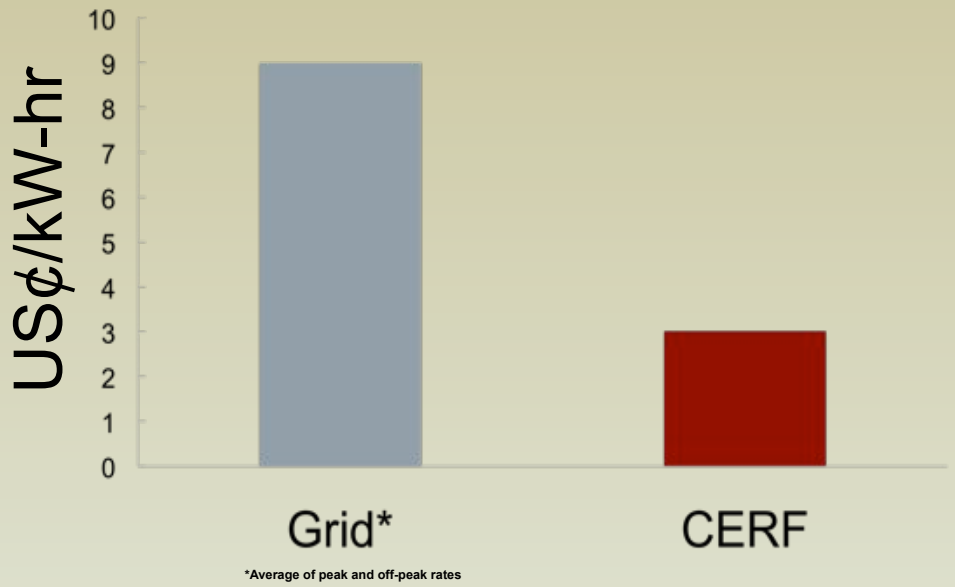
CERF Savings to Date

- 679 MWh electricity
- 663 MMBtu of natural gas
- 605 566 gallons of water
- 503 Metric tons of CO_2
- $56 978.76

If Used by the Typical Michigan Resident

- 65 years of electricity
- 8 years of natural gas
- 30 years of CO_2 emissions
- 18 years of water

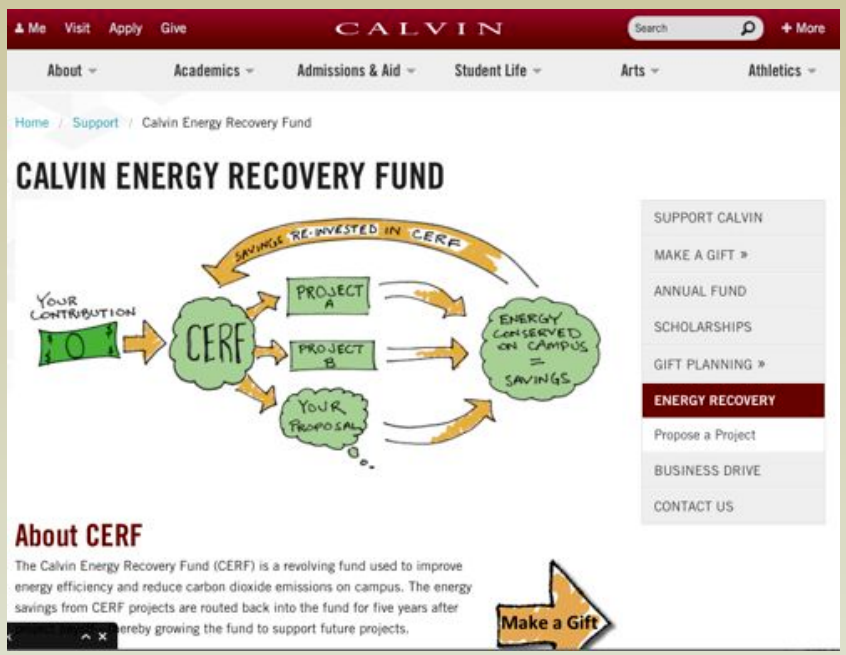
CERF Performance



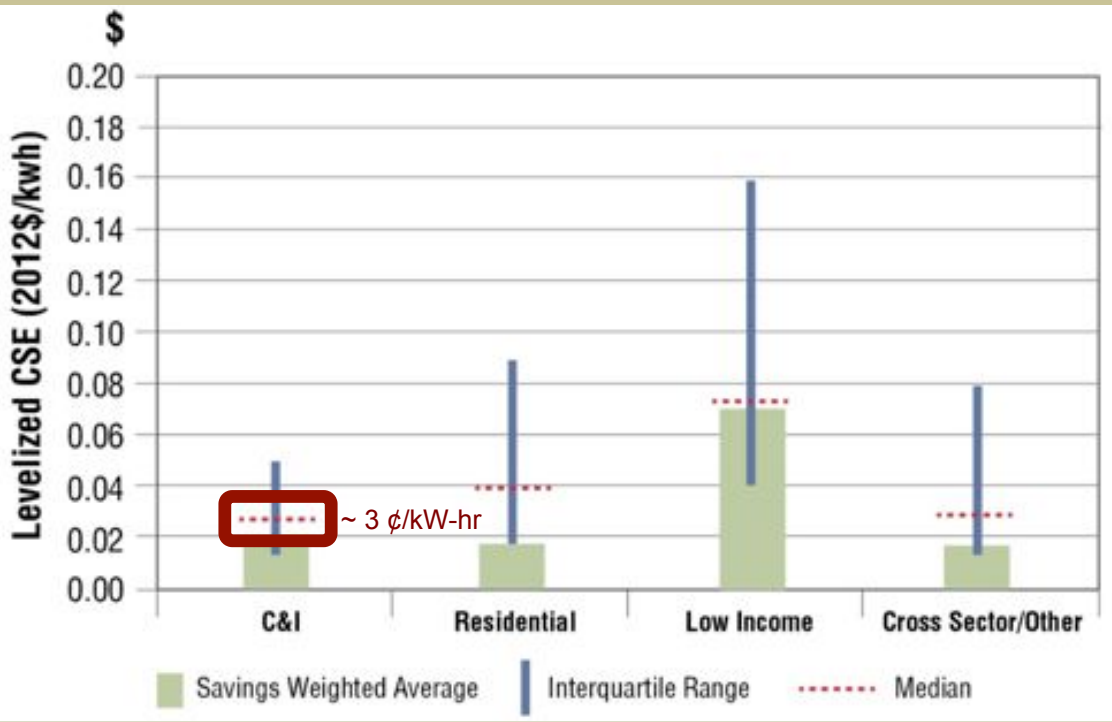
Notes

- Student involvement throughout
  - Service learning works!
  - Interdisciplinary learning opportunities
- Fully embedded in college faculty governance structure
- Carefully tracking comparable metrics for energy and CO_2
- Implemented without a sustainability coordinator

Fundraising



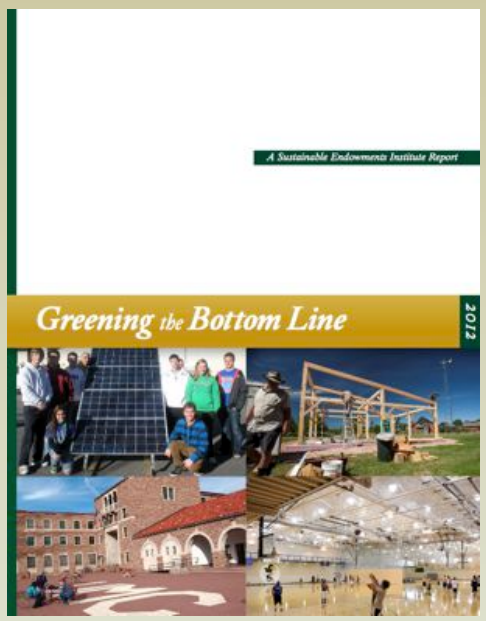
https://www.calvin.edu/support/energy/



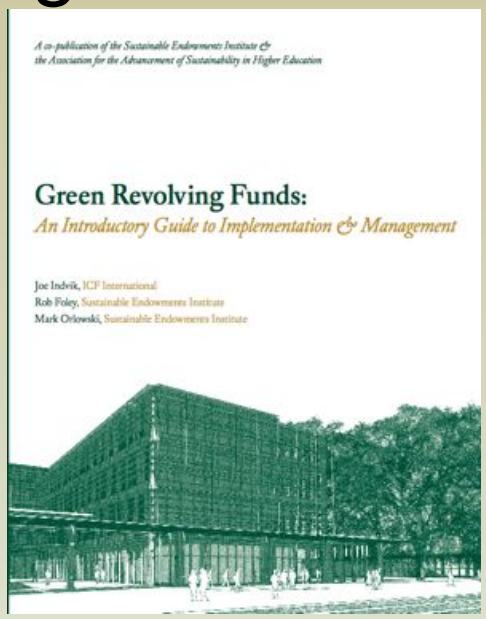
Billingsley, M.A., et. al. *The Program Administrator Cost of Saved Energy for Utility Customer-Funded Energy Efficiency Programs.* Lawrence Berkeley National Laboratory. March 2014.

Green Billion Challenge

http://greenbillion.org



http://greenbillion.org/wp-content/uploads/2012/11/Greening-the-Bottom-Line-2012.pdf



http://greenbillion.org/wp-content/uploads/2013/01/GRF_Implementation_Guide.pdf

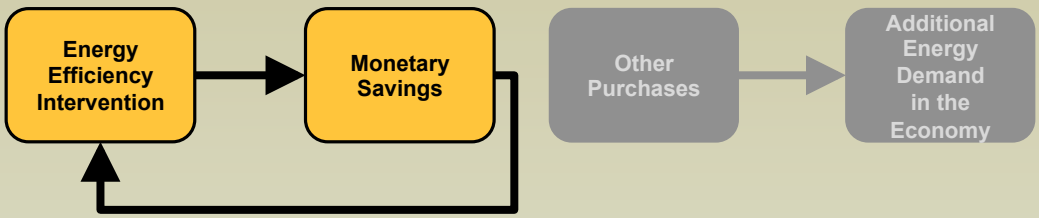
Response to divestment pressure from students

Avoid Capability Trap

- EE analysis done by interns
- EE savings are protected
- Long payback times (~5 years) are acceptable

- Carefully develop EE expertise

GRFs and the Rebound Effect



What *Does* It Take…?

- An account with seed funding
- Policies
- Doers
- A manager
- Oversight
- Integrity
- Fortitude

Financial Innovation

Two Stories

"We don't need this."

"Accounting systems change behavior."

Further Information

- CERF Student Project Reports and Presentations http://www.calvin.edu/~mkh2
- Green Billion Challenge http://greenbillion.org
- Calvin College Statement on Sustainability http://www.calvin.edu/admin/provost/environmental/sustainabilitystatement.html
- mkh2@calvin.edu