ENGR 333 Presentation

What would it take for Calvin to implement an energy efficiency fund?

Calvin Energy Efficiency Fund
What is an Energy Efficiency Fund?

- Seed Money
- Project Funding
- ENERGY EFFICIENCY FUND
- ENERGY SAVING PROJECTS
- Savings
What Colleges Have This Type of Fund?

- Harvard University
  - Green Loan Fund
    - Savings ~$900,000 (30% ROI)
- University of Michigan
  - Energy Conservation Measures Fund
    - Projected savings of $5.7 million
- UC Berkeley
- Macalester College

Why is this Type of Fund Important?

- Conserves energy and money
- Educates about sustainability and fiscal responsibility
- Improves record and visibility of creation care
- Recycles savings to make change
The Question

What would it take for Calvin to implement an energy efficiency fund?
Answering the Question

Policy Group
- Develop structure and policies to govern the Calvin Energy Efficiency Fund (CEEF)

Technical Groups 1-3
- Research and analyze proposed CEEF projects for energy savings

Financial Group
- Analyze financial cash flows of CEEF and proposed projects
Policy Group

- Mission Statement
- Management
- Project Types
- Project Life Cycle
- Cost Responsibilities
- Allocation
- Project Hand-off
“We continually investigate new technologies for improved energy systems and more efficient use of energy resources.”

“Promote linkage between energy conservation effort with programs to reduce carbon dioxide emissions and contributions to global warming.”

“…starting points for education and action.”
The purpose of the Calvin Energy Efficiency Fund is to pursue our calling to be stewards of God’s creation by implementing a process through which Calvin’s Campus can promote and realize a goal of energy stewardship and accommodate renewable and sustainable energy- and cost-saving projects.
CEEF Management

- **CEEF Board**
  - Final project approval
  - Allocates finances

- **CEEF Intern**
  - Liaison b/w Board & Club
  - Leads CEEF Club

- **CEEF Club**
  - Conducts research and savings analysis
**CEEF Project Types**

**Blue Projects**
- Short term energy efficiency projects
  - \( \leq 10 \) yr payback

**Green Projects**
- Reduce carbon emissions
- Raise awareness for sustainability and renewable energy
- Long term energy efficiency projects
  - > 10 yr payback
Project Life Cycle

Phases

I: Project Proposal
II: Initial Project Review
III: Detailed Project Analysis
IV: Final Project Review
V: Project Implementation
VI: Project Active Period
VII: Project Hand-off
Cost Responsibilities

• Direct Costs
  • Differential Project Costs
    • Labor
    • Materials
    • Maintenance

• Indirect Costs
  • CEEF Intern Wages
CEEF Allocation

CALVIN ENERGY EFFICIENCY FUND

SAVINGS

DIRECT & INDIRECT COSTS

~80%

~20%

BLUE PROJECTS

GREEN PROJECTS

INTERN WAGES

SEED MONEY

CONTINGENCY
• Release of Project from CEEF
  • 5 years after complete payback period
    • In out-year dollars
  • All costs and savings assumed by Calvin College
## Proposed CEEF Projects

1. Solar path lights / switch to LEDs
2. Get rid of food trays in dining halls to cut down on dish washing and food costs
3. Decrease mowing / lawn care costs with more gardens / wooded areas
4. Add radiator thermostats to each dorm room (regulate dorm heating better)
5. Hand dryers in restrooms instead of paper towels
6. Isolate air conditioning to offices and labs in the summer
7. More efficient dryers in dorms or promote use of clothes lines for drying laundry instead
8. Consolidate or ban mini-fridges in dorms and replace with large kitchen fridge system
9. Use exhaust heat from the dining hall ovens and/or wash/dry cycle to heat the dining hall and/or nearby buildings
10. Recycle rain and snow melt water for irrigation
11. Disable handicap doors when button is not pressed so door shuts quicker during normal operation
12. Recycle drinking fountain waste water
13. Reroute Sem. Pond to produce hydro-electric power
14. Bookstore textbook reservation boxes that can be returned and reused
15. Food scrap composting bins in the dining hall
16. Install push button sink faucets and/or showers in dorms
17. Professors use electronic distribution and submission of assignments, notes, etc.
18. Students pay for trash (especially at move-out time)
19. More efficient toilets (less water used in flushing)
20. Campus safety on bikes, hybrid cars or Segways (decrease campus safety car usage in general)
21. Provide incentive for students and professors to walk, take the bus, or ride bikes to campus
22. More efficient dining hall ovens and/or dish washers/dryers.
Proposed CEEF Projects

Project Specifics:

• Proposed Project
• Project Details
• Energy Savings
• Upfront Costs
Proposed CEEF Projects

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 Tunnel
8. CDH Windows
9. Dorm Hall Lights
Tech Group 1 Project Overviews

Descriptions:

1. North Hall - **Light Replacement**
   T12 → T5

2. Res. Hall Basements - **Motion Sensors**
   Study, Laundry, Common (x2 wings)

3. Hekman Library - **Light Harvesting**
   Automatic sensors – switch off lights based on light coming from windows
   (5th Floor)
## Tech Group 1 Analysis Results

### ENERGY SAVINGS / UPFRONT COSTS

<table>
<thead>
<tr>
<th>Project Location</th>
<th>Energy Savings [kWh/yr]</th>
<th>1st Year Cost Savings [$]</th>
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<tbody>
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<td>North Hall – Light Replacement</td>
<td>45,220 (±22%)</td>
<td>$3,920</td>
<td>$59,420 (±10%) + $87.92/yr (ongoing)</td>
<td>12</td>
</tr>
<tr>
<td>Residence Hall Basements – Motion Sensors</td>
<td>86,420 (±18%)</td>
<td>$7,500</td>
<td>$25,900 (±10%)</td>
<td>3</td>
</tr>
<tr>
<td>Hekman Library – 5th Floor Light Harvesting</td>
<td>12,320 (±7%)</td>
<td>$1,070</td>
<td>$4,320 (±10%)</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: All $ amounts are in 2008 values.
Tech Group 1 Project Details

1. North Hall - Light Replacement
   Current: T12 lamps and fixtures, magnetic ballasts
   Upgrade: T5 lamps, RT5 fixtures, electronic ballasts
Tech Group 1 Project Details

1 North Hall - Light Replacement

Figure: North Hall – Ground Floor Light Usage Zones

Source: Don Levy, Physical Plant
## Tech Group 1 Project Details

### North Hall - Light Replacement

#### Energy Consumption

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current (A)</td>
<td>0.75 A</td>
<td>0.5 A</td>
</tr>
<tr>
<td>Power (kW)</td>
<td>0.09 kW</td>
<td>0.06 kW</td>
</tr>
<tr>
<td>Fixtures</td>
<td>460 fixtures</td>
<td>352 fixtures</td>
</tr>
<tr>
<td>Consumption (kWh)</td>
<td>88,030 kWh/yr</td>
<td>42,810 kWh/yr</td>
</tr>
</tbody>
</table>

**Energy Savings:** 45,220 kWh/yr

**1st Year Cost Savings:** $3,920
Tech Group 1 Project Details

North Hall - Light Replacement

Upfront Costs

- T5 lamp: $5.21 (2 per fixture)
- Electronic ballast: $35.92 (1 per fixture)
- RT5 fixture: $84.00 ea (352 fixtures)
- Other materials: $2500 per floor
- Labor: $6,160 (½ hour labor per fixture at $35/hr)

TOTAL: $59,420.00

Ongoing Costs

- T5 Lamp replace: ~$4.00 ea (life = 8-10 yr)

TOTAL ONGOING: $87.92 / year
2 Residence Halls – Motion Sensors

Install motion detectors in all residence hall basement common areas:

- Study room
- Common room
- Laundry room

“Dual Technology”
ultrasonic + infrared

Figure: WattStopper DT-300 (Ceiling Mounted)
Source: www.wattstopper.com
Tech Group 1 Project Details

2 Residence Halls – Motion Sensors

- **Common Room:** 4 sensors (DT-300 ceiling mounted)
- **Study Room:** 1 sensor (DT-300 ceiling mounted)
- **Laundry Room:** 1 sensor (DT-200 wall mounted)

*Figure: Vanderwerp Basement – Motion Sensor Rooms*

Source: Don Levy, Physical Plant
## Residence Halls – Motion Sensors

Energy Consumption

- **Usage Hours**

<table>
<thead>
<tr>
<th>Room</th>
<th>Existing</th>
<th>Proposed</th>
<th>Fixtures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study</td>
<td>16 hrs/day</td>
<td>10 hrs/day</td>
<td>(20)</td>
</tr>
<tr>
<td>Laundry</td>
<td>12 hrs/day</td>
<td>4 hrs/day</td>
<td>(12)</td>
</tr>
<tr>
<td>Common</td>
<td>24 hrs/day</td>
<td>16 hrs/day</td>
<td>(30)</td>
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**Assumption:** 243 days/year (lights off in the summer)
### Residence Halls – Motion Sensors

#### Energy Consumption

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<th>Existing [kWh/yr]</th>
<th>Proposed [kWh/yr]</th>
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<tbody>
<tr>
<td>Study</td>
<td>3,920</td>
<td>2,450</td>
</tr>
<tr>
<td>Laundry</td>
<td>2,650</td>
<td>880</td>
</tr>
<tr>
<td>Common</td>
<td>8,820</td>
<td>5,880</td>
</tr>
<tr>
<td>TOTAL (all 14 wings)</td>
<td>215,350</td>
<td>128,940</td>
</tr>
</tbody>
</table>

**Energy Savings:** 86,420 kWh/yr

**1st Year Cost Savings:** $7,500
Tech Group 1 Project Details

Residence Halls – Motion Sensors

Upfront Costs

- **DT-300 (ceiling):** $150 ea (study + common)
- **DT-200 (wall):** $50 ea (laundry)
- **Material/Labor**
  - Study: $300/room
  - Laundry: $150/room
  - Common: $600/room

---

**TOTAL (all wings):** $25,900
Hekman Library – *Light Harvesting*

Install “light harvesting” system on 5th Floor

**Current:**
T8 fluorescent lamps and fixtures
0.42 A per fixture

**Upgrade:**
Add daylight photosensors
121 fixtures in five “zones”
Tech Group 1 Project Details

Hekman Library

Lighting zones
- 15 ft from windows
- Five zones, controls

Light levels
- Minimum: ~ 50 fc

Simplicity
- on/off only
  no dimming!

Source: Don Levy, Physical Plant
Tech Group 1 Project Details

3 Hekman Library – Light Harvesting

Figure: WattStopper Photosensor – LS-290C v2

Cutoff level: 100fc

Source: www.wattstopper.com
## Tech Group 1 Project Details

### Hekman Library – Light Harvesting

#### Energy Consumption

<table>
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<th>Zone</th>
<th>Existing [kWh/yr]</th>
<th>Proposed [kWh/yr]</th>
<th>(fixtures)</th>
</tr>
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<tbody>
<tr>
<td>North</td>
<td>6,930</td>
<td>3,670</td>
<td>(32 fixtures)</td>
</tr>
<tr>
<td>East</td>
<td>4,120</td>
<td>2,180</td>
<td>(19 fixtures)</td>
</tr>
<tr>
<td>South</td>
<td>3,680</td>
<td>1,950</td>
<td>(17 fixtures)</td>
</tr>
<tr>
<td>West</td>
<td>4,550</td>
<td>2,410</td>
<td>(21 fixtures)</td>
</tr>
<tr>
<td>Reading Room</td>
<td>6,930</td>
<td>3,670</td>
<td>(32 fixtures)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>26,200</strong></td>
<td><strong>13,880</strong></td>
<td>(121 fixtures)</td>
</tr>
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**Energy Savings:** 12,325 kWh/yr

**1st Year Cost Savings:** $1,070
Hekman Library – Light Harvesting

Upfront Costs

- Sensor Package: $500 ea (x5 zones)
- Other materials: $420
- Labor: $1,400 (8 hours per zone at $35/hour)

TOTAL: $4,320

Dimming Ballasts (option)

- Dimming Ballast: $100 ea (121 fixtures)
- Added Labor: $2,120 (1/2 hr per fixture)

TOTAL (w/ dimming): $18,600
## Tech Group 1 Analysis Results

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5. Solar Water Heating
6. Forced Computer Shutdown

Tech Group 3
7. Dorm Tunnel
8. CDH Windows
9. Dorm Hall Lights
Tech Group 2 Project Overviews

Descriptions:

4. Chapel – Chapel Airlock
   Vestibule on main entrance

5. Fieldhouse – Solar Water Heating
   Solar collectors on roof to heat water

6. All Campus – Forced Computer Shutdown
   Program to turn-off Calvin owned computers
### Tech Group 2 Analysis Results

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<td>Chapel – Chapel Airlock</td>
<td>1640 [therms/yr] (+20%/-50)</td>
<td>$1,400</td>
<td>$18,000 (±15%)</td>
<td>11</td>
</tr>
<tr>
<td>Fieldhouse – Solar Water Heating</td>
<td>98,800 [therms/yr] (±10%)</td>
<td>$81,800</td>
<td>$3,530,000 (±5%/-20)</td>
<td>26</td>
</tr>
<tr>
<td>All Campus – Forced Computer Shutdown</td>
<td>348,600 [kWh/yr] (±7%)</td>
<td>$30,300</td>
<td>$20,600 (±10%)</td>
<td>0</td>
</tr>
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Note: All $ amounts are in 2008 values.
4 Chapel – Chapel Airlock

Existing: Single bank of doors
Proposed: Double door airlock
Chapel – Chapel Airlock

Energy Savings

- Summer vs. Academic Year
- Savings based on MIT study using
  - Traffic rate (100 people/hr)
  - Pressure differential (0.01” water)
  - Number of doors (6)

Energy Savings: 1,640 therms/yr

1st Year Cost Savings: $1,400

Assumption: Doors will not be held open
Auditing: Compare data to historical data
4 Chapel – Chapel Airlock

Upfront Costs

- Construction: $18,000*

TOTAL: $18,000

*This is based on a quote that will need to be updated if project is approved.
Tech Group 2 Project Details

5 Fieldhouse – Solar Water Heating

Figure: Thermo Technologies 30 Tube Solar Collector
Tech Group 2 Project Details

5 Fieldhouse – Solar Water Heating

Figure: Installation at Kalamazoo D.O.T.
Fieldhouse – Solar Water Heating

Energy Savings
- Can be incorporated to heat the pool or campus hot water supply
- Solar energy data taken from Thermo Technologies
- Assumes 1,000 collectors on south side of Fieldhouse roof (max capacity)

Energy Harvested: 98,800 therms/yr
1st Year Cost Savings: $81,800

Auditing: Controller unit records energy savings
Fieldhouse – Solar Water Heating

Upfront Costs

- Solar Collector: $3,450* ea (x 1000**)
- Pump: $1,700
- Heat Exchanger: $31,300
- Piping: $14,300 (18$/ft)
- Labor: $45,500 (35 $/hr, 1.3 hr/collector)

TOTAL: $3,540,000

* This is based on a quote for a single panel, a discount can be expected for a large order.
** The system is scalable. 1000 collectors is the max.
Tech Group 2 Project Details

6 All Campus - Forced Computer Shutdown
Projected Energy Savings

Existing:

Proposed:

Lab Computers
Staff Computers
Other Computers
### Project Details:

**All Campus - Forced Computer Shutdown**

**Projected Energy Savings**

<table>
<thead>
<tr>
<th></th>
<th>Days/Yr</th>
<th>Shutdown Hours</th>
<th>Energy Savings [kWh/yr]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Computers</td>
<td>200</td>
<td>1 am-7 am</td>
<td>36,697</td>
</tr>
<tr>
<td>Staff Computers</td>
<td>300</td>
<td>6 pm-7 am</td>
<td>198,449</td>
</tr>
<tr>
<td>Other Computers</td>
<td>200</td>
<td>1 am-7 am</td>
<td>113,455</td>
</tr>
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Energy Savings: **348,600 kWh/yr**

1st Year Cost Savings: **$30,300**

Auditing: Software calculates energy savings
6 Tech Group 2 Project Details

All Campus - Forced Computer Shutdown

Upfront Costs

- Labor: $175 (5 hrs @ $35/hr)
- Licensing Cost: $20,434 ($7.20 per station)

No Renewal Fee
Software is an add-on to Deep Freeze

TOTAL: $20,600
**ENERGY SAVINGS / UPFRONT COSTS**

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Tech Group 3
7. Dorm Tunnel
8. CDH Windows
9. Dorm Hall Lights
Tech Group 3 Project Overviews

Descriptions:

7 Underground – **Dorm Tunnels**
Tunnels to re-route HVAC piping and disconnect steam boilers

8 **Commons Dining Hall** – **Windows**
Replace single for double paned windows

9 **Res. Halls** – **Dorm Hall Lights**
Shut-off hall lighting at additional times
# Tech Group 3 Analysis Results

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<tbody>
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<td>Underground – Dorm Tunnels</td>
<td>51,105 (±10%) [therms/yr]</td>
<td>$42,330</td>
<td>$83,500 (±11%)</td>
<td>1</td>
</tr>
<tr>
<td>Commons Dining Hall – Windows</td>
<td>24,800 [therms/yr] + 2,370 [kWh/yr] (±10%)</td>
<td>$17,710</td>
<td>$165,000 (±10%)</td>
<td>8</td>
</tr>
<tr>
<td>Residence Halls – Lights</td>
<td>18,542 (±10%) [kWh/yr]</td>
<td>$1,610</td>
<td>$35 (±20%)</td>
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Tech Group 3 Project Details

7 Underground – Dorm Tunnels

Existing: Steam boilers in KDH (~63% efficient)
(Supply to 4 dorms and KDH)

Proposed: Connect via tunnel to hot water
boilers in SB plant (~92% efficient)
(Supply most of Campus)
Tech Group 3 Project Details

Current Heating Loop

Proposed Heating Loop
Energy Consumption:
- Heating load only

<table>
<thead>
<tr>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ 63% efficient</td>
<td>~ 92% Efficient</td>
</tr>
<tr>
<td>162,000 [therms/yr]</td>
<td>111,000 [therms/yr]</td>
</tr>
</tbody>
</table>

Energy Savings: **51,000 therms/yr**

1st Year Cost Savings: **$42,330**

Assumptions: 75% of natural gas supplied to steam boilers is used for heating

Auditing: Monitor yearly changes in natural gas supply

Source: Paul Pennock, Physical Plant
Underground – Dorm Tunnels

Upfront Costs:

• Tunneling and Piping: $83,500
  200 feet tunneling
  Includes all labor and materials for:
  excavation, concrete work and sealing,
  heating pipes and fixtures, backfill, seed

  Hot water pipes through dorm connecting systems

Additional Benefits:

  Space provided in tunnel for addition of cooling pipes
Tech Group 3 Project Details

8 Commons Dining Hall – **Windows**

Existing: Single Pane Windows
Proposed: Double Pane Windows
### Commons Dining Hall – Windows

Energy Consumption:

<table>
<thead>
<tr>
<th></th>
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<th>Proposed</th>
</tr>
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<tbody>
<tr>
<td>Heating</td>
<td>5120 [therms/yr]</td>
<td>1840 [therms/yr]</td>
</tr>
<tr>
<td>Cooling</td>
<td>73300 [kWh/yr]</td>
<td>72300 [kWh/yr]</td>
</tr>
</tbody>
</table>

Energy Savings:
24,759 therms/yr + 2,373 kWh/yr

1st Year Cost Savings: **$17,710**
Tech Group 3 Project Details

8 Commons Dining Hall – Windows

Upfront Costs:
$165,000
Includes: Labor and Material

Source: Vos Glass
Residence Halls – Dorm Hall Lights

Current: Shut off ½ lights 11pm – 6am
Upgrade: Shut off ½ lights 11pm – 6am & 11am – 4pm
## Residence Halls – Dorm Hall Lights

### Energy Consumption

<table>
<thead>
<tr>
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<th>Existing</th>
<th>Proposed</th>
</tr>
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<tbody>
<tr>
<td>Hours Off</td>
<td>7 hours off</td>
<td>12 hours off</td>
</tr>
<tr>
<td>kWh/yr</td>
<td>162,000</td>
<td>143,000</td>
</tr>
</tbody>
</table>

Energy Savings: **19,000 kWh/yr**

1st Year Cost Savings: **$1,610**

Upfront Costs:
- **$35** (1 hour labor)
# Tech Group 3 Analysis Results

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<td>$35 (±20%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: All $ amounts are in 2008 values.
Financial Group

- Energy Projections
  - Electrical Cost Outlook
  - Natural Gas Cost Outlook
- Project Evaluation Approach
  - Project Cash Flow Diagrams
  - Project Payback Periods
- Project Implementation Dates
- Financial Considerations
- Pessimistic & Optimistic Cases
- Fund Cash Flow Diagram
Energy Projections


- Modeled until 2030
- Linear projection beyond 2030

DOE Assumptions:

- Oil & gas supplies have 20% exponential decline
  - Shallow water natural gas supplies have 30% exponential decline
- Costs to produce renewable energy decline
Electrical Cost Outlook

![Graph showing electrical cost outlook from 2005 to 2055. The graph compares price ($/kWh) over years with three lines representing DOE High, Nominal, and DOE Low scenarios.]
Natural Gas Cost Outlook

Price ($/therm) vs. Year
Project Evaluation Approach

• Evaluated based on immediate installation
• Compared against an opportunity cost of capital of 6% (nominal case)
• Evaluated in out-year dollars
• Requested nominal, pessimistic, optimistic values to create multiple scenarios
Small Scale Nominal Project Cash Flows

Project Cash Flow (Out-Year $)

- Light Replacement
- Light Harvesting
- Chapel Airlock
- Dorm Hall Lights
- Motion Sensors

Project Timeline (years)
Large Scale Nominal Project Cash Flows

Project Timeline (years)

Forced Computer Shutdown
Solar Water Heating
Dorm Tunnels
Commons Dining Hall Windows
<table>
<thead>
<tr>
<th>Project</th>
<th>Payback Period (years)</th>
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</thead>
<tbody>
<tr>
<td>Dorm Tunnels</td>
<td>1</td>
</tr>
<tr>
<td>Commons Dining Hall Windows</td>
<td>8</td>
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<tr>
<td>Dorm Hall Lights</td>
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<tr>
<td>Computer Shutdown</td>
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<tr>
<td>Solar Water Heating</td>
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<td>Chapel Airlock</td>
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<td>Light Harvesting</td>
<td>3</td>
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<tr>
<td>Motion Sensors</td>
<td>3</td>
</tr>
<tr>
<td>Light Replacement</td>
<td>12</td>
</tr>
<tr>
<td>Shorter is Better</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The payback period is the time it takes for the savings from the project to equal its initial cost.
Project Implementation Dates

2009
5. Forced Computer Shutdown
7. Dorm Hall Lights
9. Dorm Tunnels

2010
2. Motion Sensors
3. Light Harvesting
4. Chapel Airlock

2011
1. Light Replacement

Not Scheduled
6. Solar Water Heating
   • scale beyond fund
8. Commons Windows
   • high upfront costs, but could be integrated into the Commons remodel
Financial Considerations

• **Intern Wages**
  • $8/hr, 10-15 hr/week, 32 weeks/yr

• **Upfront and ongoing costs projected on inflation only**
  • 4.1% inflation (nominal)
  • Technological advances & scarcity issues not considered

• **Savings & costs balanced annually**
# Pessimistic & Optimistic Cases

<table>
<thead>
<tr>
<th></th>
<th>Pessimistic</th>
<th>Nominal</th>
<th>Optimistic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upfront Costs</strong></td>
<td>High ↑</td>
<td>Nominal -</td>
<td>Low ↓</td>
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<tr>
<td><strong>Ongoing Costs</strong></td>
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<td>Nominal -</td>
<td>Low ↓</td>
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<tr>
<td><strong>Energy Savings</strong></td>
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<td>Nominal -</td>
<td>High ↑</td>
</tr>
<tr>
<td><strong>Energy Cost Projection</strong></td>
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<td>Nominal -</td>
<td>High ↑</td>
</tr>
<tr>
<td><strong>Opportunity Cost of Capital</strong></td>
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<td>Nominal -</td>
<td>Low ↓</td>
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<tr>
<td><strong>Inflation Rate</strong></td>
<td>High ↑</td>
<td>Nominal -</td>
<td>Low ↓</td>
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<tr>
<td><strong>Fund Investment</strong></td>
<td>Low ↓</td>
<td>Nominal -</td>
<td>High ↑</td>
</tr>
<tr>
<td><strong>Intern Costs</strong></td>
<td>High ↑</td>
<td>Nominal -</td>
<td>Low ↓</td>
</tr>
</tbody>
</table>
Fund Cash Flows

Fund Timeline (years)

Fund Cash Flows

Optimistic

Nominal

Contingency
Proposed CEEF Projects

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 Tunnel
8. CDH Windows
9. Dorm Hall Lights
Conclusion

- Calvin Energy Efficiency Fund is feasible
- Opportunity for Calvin to save money
- Many other potential energy efficiency projects
- Further steps in creation care
What We Learned

• Coordination between Groups
• Communication with Resources
• Value of Deadlines
• Accountability
• Relationship between Engineering and Stewardship
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And Many Others
Questions