An Analysis of Herty Resource Consumption

W. Mutunda, P. Mcnair, R. Roberts,
M. Crawford, K. Sorrells,
J. Elarbee, Dr. Busch

Herty Energy Consumption

- Analysis of:
  - Water Consumption
  - Electricity Consumption
  - Climate Control

Herty Water Consumption

- Based on 2012 water usage data, Herty's average monthly water usage is 35,000 gal.
- Herty's HVAC system produces an estimated 15,000 gal each month from condensate.
- **No systems** are in place to collect or reuse lost condensate water.

Improving Herty Hall Water Consumption

- Valves on Bathroom Sinks
- Valves on Toilets
- Use Rain Runoff to Water Roof GreenHouse
- Using the Air Conditioner Condensate to Water the GreenHouse

Restroom Water Consumption

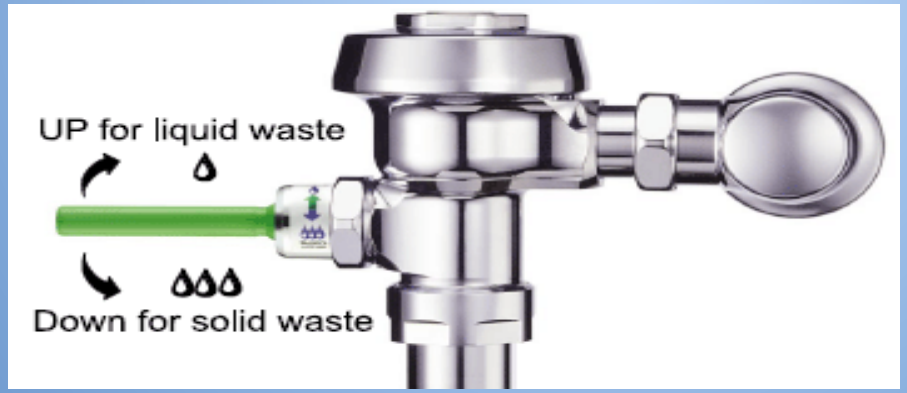
- Herty Average Consumption:
  - 8,200 Gallons per Month for Restroom Usage
  - This Amount is Equivalent 61,750 17oz Water Bottles

Sink Water Reduction

- Sinks Use 2.2 Gallons per Minute
- Put low-flow aerators on the sinks to reduce the water flow
- Aerators cost $1 to $5 and reduce the flow to 1.5 gallons per minute
- Savings of 0.7 gallons per minute

Toilet Water Consumption

- Install Dual-Flush Toilet Valves
  - Use less water usage to dispose of liquid waste
  - Solid waste will use the original 1.6 gallons per flush
  - Liquid waste will use 1.1 gallons per flush



Waterless or High Efficiency Urinals

- Zero Gallons per Flush
- Expensive to install and maintain

- Uses 0.12 Gallons per Flush
- No more maintenance than standard urinals

Rooftop GreenHouse

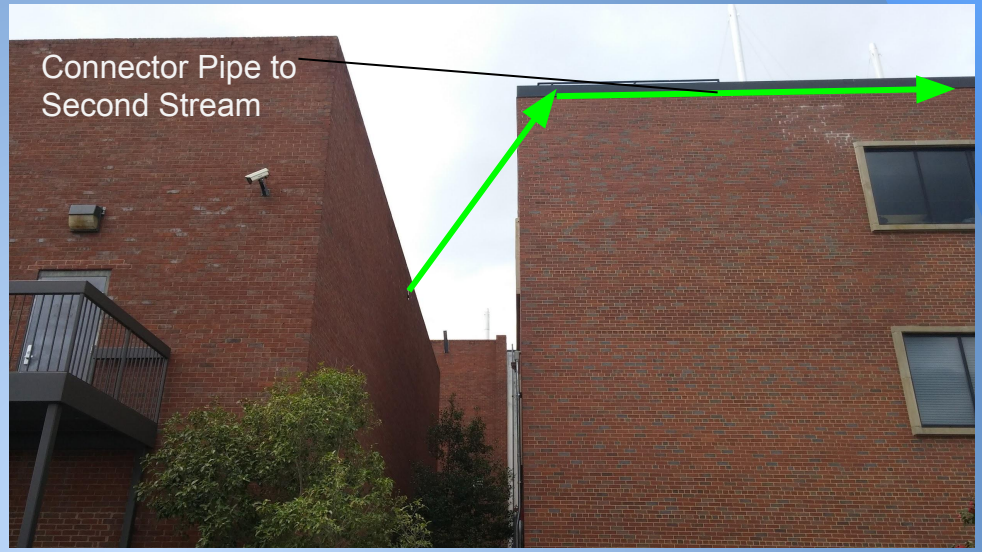
- Approximately 35,000 gallons of water land on the greenhouse every year

GreenHouse Swamp Cooler Improvement

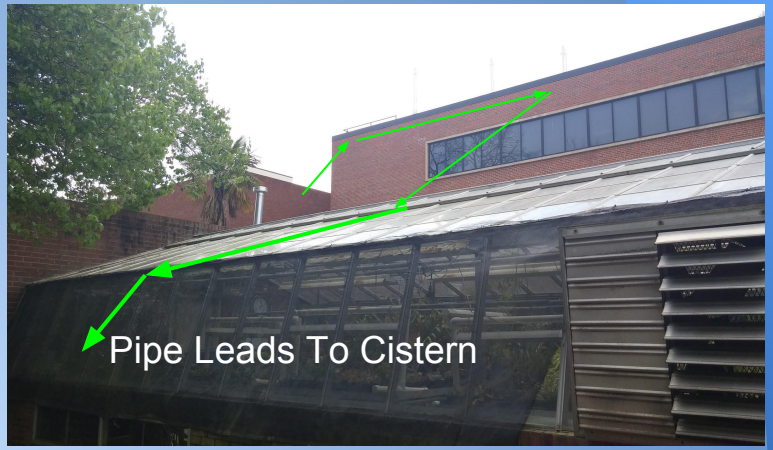
Standalone GreenHouse

Condensate for GreenHouse

- The Air conditioning systems on the roof produce condensate
- Condensed water vapor coming from inside the building


Connector Pipe to
Second Stream

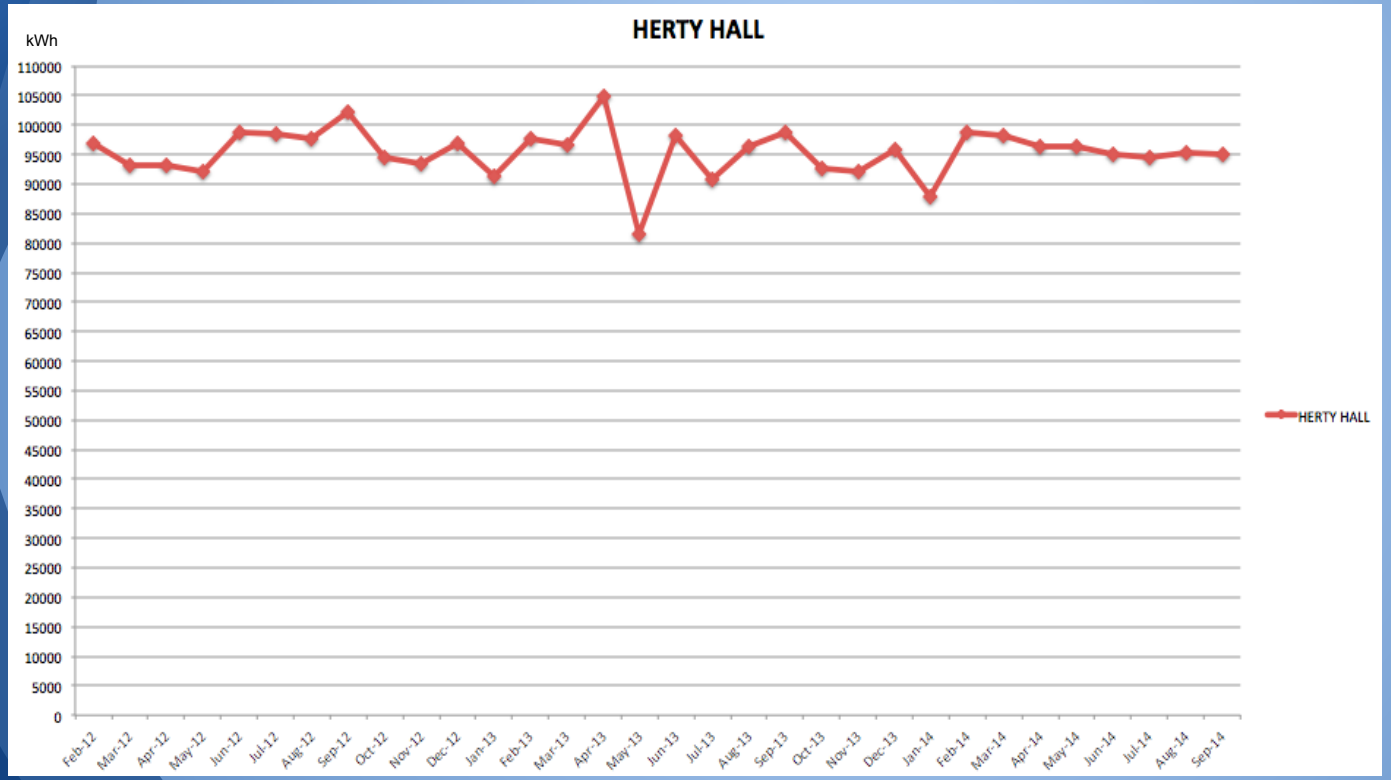

Pipe Goes Across
to GreenHouse at
this Point


Pipe Leads To Cistern

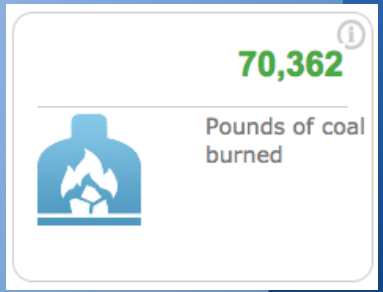

Pipe Leads to Cistern


Cistern Placed Here

Electricity Consumption



Average of 65.5 tons of CO_2 produced monthly.



Areas To Reduce Electrical Waste

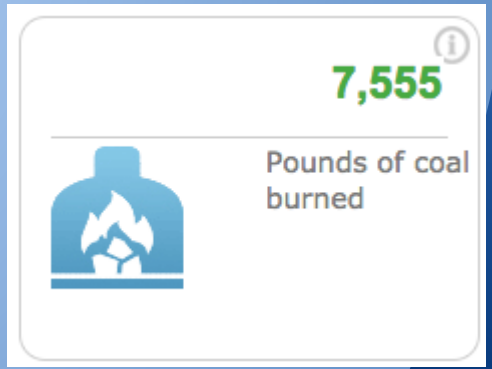
- Controlling HVAC Systems
- Regulating After-Hours Lighting
- Upgrade Herty Front Entrance
- Retrofit Windows

Cost of Herty's HVAC Systems

- The HVAC systems account for over 30,000 kWh each month.
- The monthly bill from the system falls between $3000 and $4000.
- This accounts for a monthly production of 20.7 tons of CO2.

Benefits of Installing Regulators

- The 1st floor and rooftop air handlers all run without variable control.
- By installing efficiency controls, energy use could be reduced by an estimated 30%.
  - This would reduce monthly usage by over 10,000 kWh
  - Monthly CO_2 emissions would decrease by 7 tons.
  - Between $918 and $1225 would be saved monthly.



Lighting Systems

- Calculated waste from after-hour lighting usage:
  - The calculated power drawn afterhours is 10.8kWh.
  - Accounting for weekends and weeknights between 10 P.M. and 6 A.M., the usage is 3800 kWh per month.
  - The total cost per-month accounts falls between $342.15 and $456.19

Vacancy/Occupancy Sensors

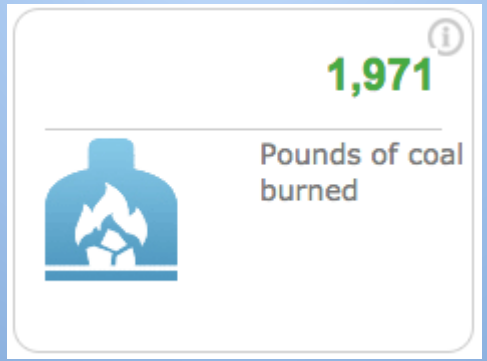
- Vacancy/Occupancy sensors are used to intelligently control room lighting based on activity.
- Different sensors can be installed depending on the need of the space
  - Infrared motion sensors for areas high levels of activity, such as hallways and stairwells.
  - Ultrasonic acoustic sensors for areas that see use, but have less motion, such as bathrooms and offices.

Costs of Sensors

- Estimated costs:
  - For the sensor needs of Herty, using Hubbell brand sensors, purchase price is approximately $4,600.
  - Installation price varies, but estimates place costs between $150 and $200 per sensor.
  - Total costs for purchase and installation is estimated between $13,200, and $15,800.

Timeline of Sensor Integration

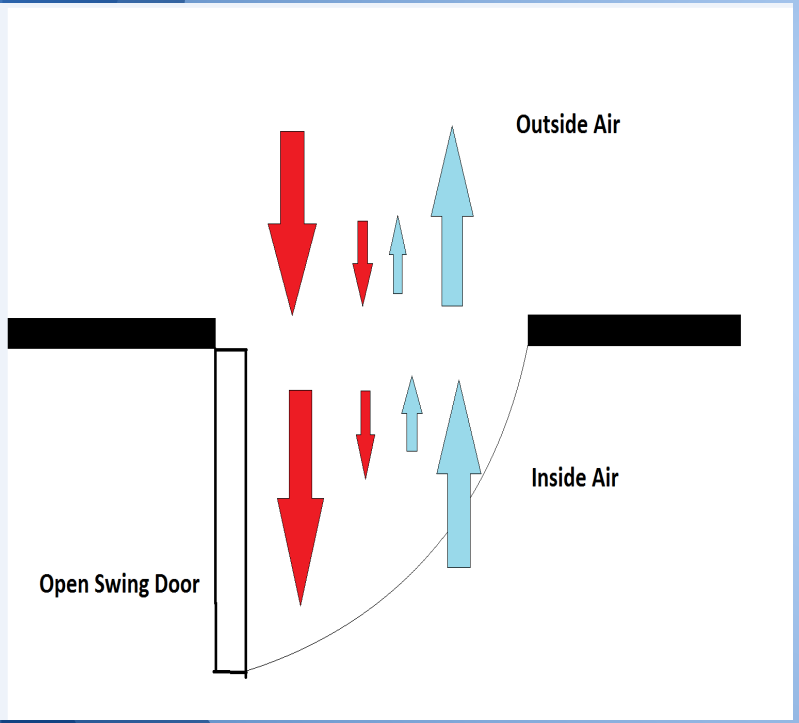
- Using a conservative estimate of 70% energy reduction after hours, the break even period is between 38 to 46 months.
- After the break even point, the monthly energy budget of Herty would be reduced by over $300.
- The implementation would result in an immediate reduction in carbon emissions by 1.8 tons of CO2 each month.



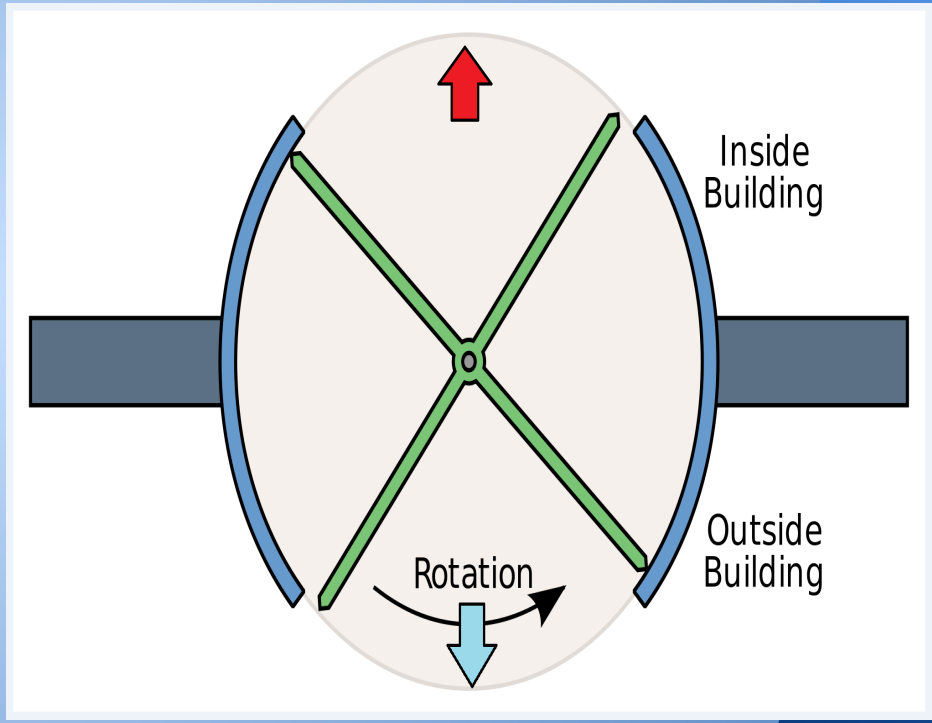
Front Entrance Attop Stairs

- We are proposing a switch from our current single swing doors to a revolving door of equivalent size

Revolving vs. Swing



vs.

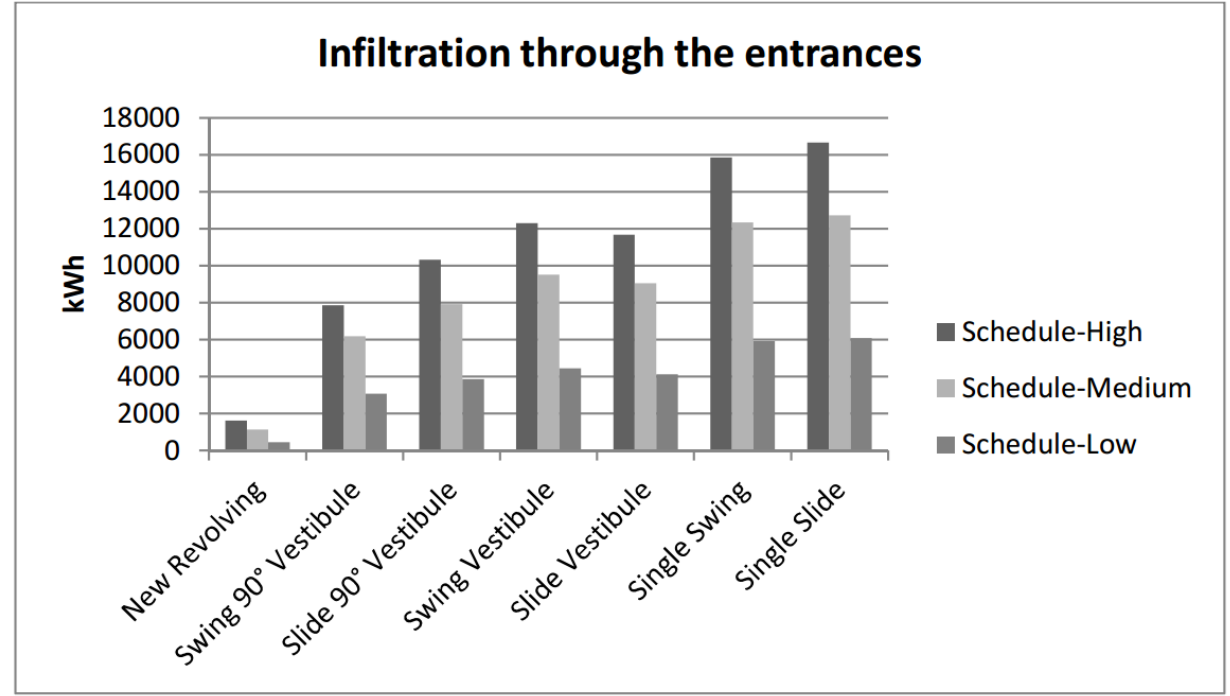


Entrances

- Annual energy loss through different types of doors

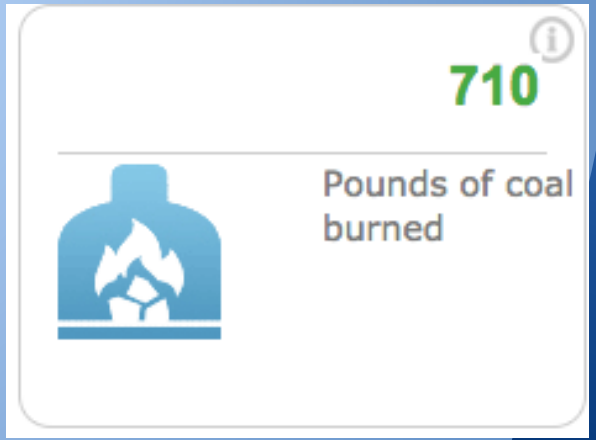
Translation:

- 1000 kWh w/ revolving door
- 12500 kWh w/ single swing door



Energy Effects

- A decrease of approximately 11500 kWh per year
- Creates a decrease in bill of 958 kWh per month or $86.22-$114.96
- This amounts to a decrease in 0.611 tons of CO_2 per month



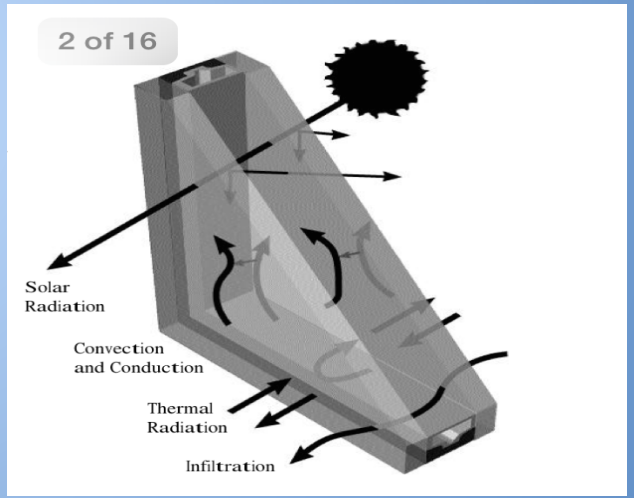
Financing

- The estimated cost of a system around this size is $3000 and upward depending on the quality of door.

- This would leave a break even time of approximately 30 months and a decrease in power usage of around $100 per month after this period.

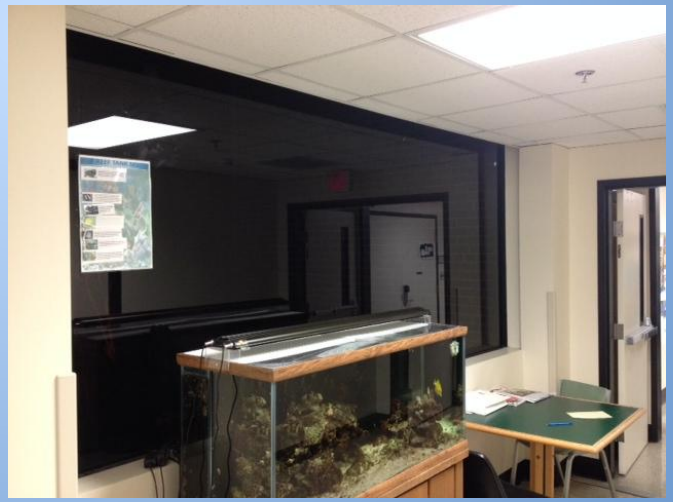
Windows

- The original Herty still uses single pane windows
- There are three different types of heat transfer
  - Conduction
  - Convection
  - Radiation
- Single pane is most vulnerable to conduction and convection because its thermal resistivity is low.



R-value

- R-value is measurement of thermal resistivity. Units $(hr*ft^2*F)/Btu$
  - Single: R=0.7-1
  - Double: R=1.2-3
  - Triple: R=2-4.5



Finances of Single Panes

- Calculated heat transfer of single pane windows in Herty in one month:
  - For one day 61.63 kWh
  - 1874 kWh per month
  - Per month this approximates to $224.93

Differences and Savings

- Switching from single to double or single to triple pane windows is advantageous
  - Single to Double will save 1151.3 kWh per month
  - this translates to $139.80 per month
  - Single to Triple will save 1553.37 kWh per month
  - this translates to $186.40

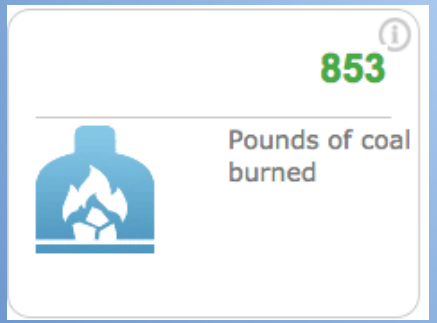
Savings Continued

- The estimated cost for double pane installation is $4.67 per ft^2
  - The total area we measured sums it to $2,301 in installation and purchase
  - This amount will be paid off in 16 months
- Installation and purchase of triple pane is $15,770
  - This will be paid off in 7 years and will save more than the double pane in the long run

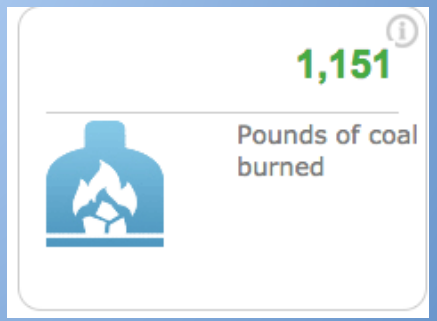
Energy in Perspective

- The measured single pane windows if retrofitted to double and triple will save approximately

Single to double
0.794 CO2 Reduction

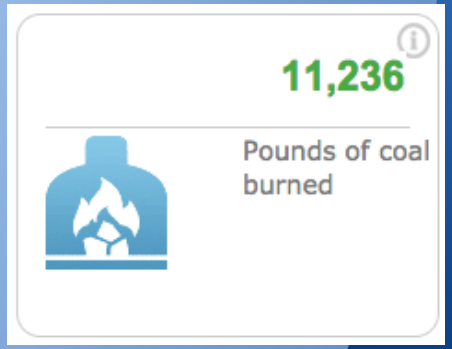


Single to triple
1.1 CO2 Reduction



Total Energy Reductions

- If the suggested improvements were implemented in Herty Hall, the results would be:
  - Monthly electricity consumption reduction by 15,170 kWh.
  - Monthly power bill reduction between $1365 and $1826.
  - Breakeven between 22 and 30 months.
  - CO_2 emissions reduced 10.5 tons monthly.



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