Vending Machine Energy Efficiency
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Introduction
Boston College (BC) possesses 146 operational vending machines located across its Main Campus, Brighton Campus, and Newton Campus. Of these 146 machines, 101 are beverage machines provided by Coca-Cola and 45 are snack machines provided by Next Generation. Vending machines are extremely energy intensive appliances that often function throughout the day, generating large electric bills for their users. BC’s 146 vending machines cost $15,529.52 and emit 119.41 tons of carbon dioxide annually.

Vending machine energy usage at BC represents a significant portion of the University’s energy expenses, thus identifying strategies to reduce energy output provides valuable insight. In order to determine all possible methods to reduce energy usage, our team documented all of the vending machines across campus, measured the energy use of multiple models, researched the available alternatives and results of implementing these changes, and created a cost-benefit analysis to quantify our findings. We examined retrofitting options including adding compressor controllers, de-lamping the machines, and utilizing energy conservation devices.

Methods
Research
• Researched external documents which described studies involving vending machine energy efficiency

Data collection
• Personally measured the energy output of drink and snack vending machines
• Collected information regarding vending machine models and best practices from BC, Next Generation and Coca Cola representatives
• Documented the model number, location, ENERGY STAR certification, and lighting in all machines

Analysis
• Created a cost benefit analysis of the data to find the best economic and environmental solutions
•Graphically represented data to more clearly understand the findings
•Contacted BC, Next Generation, and Coca Cola representatives to understand the feasibility of solutions

Results and Calculations

Figure 1: (A) Map of the distribution of Coca-Cola vending machines on BC’s Main Campus. (B) Map showing the locations of the Next Generation snack vending machines.

Figure 2: Images of the Next Generation snack vending machine (left) and Coca-Cola beverage vending machine (right).

Figure 3: Total carbon dioxide emissions (in tons) annually for the base case and each retrofitting option.

Figure 4: (A) The total energy costs of the vending machines in the base case and retrofitting options. (B) Total energy costs per vending machine in the base case and retrofitting options.

Table 1: Pros and Cons of Retrofitting Options

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<th>Pros</th>
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| LED Lights | • Free to BC  
• Brighter lights |
| Vending/ Snack Miser | • 2nd best cost and C02 savings  
• Lengthens life of machine³  
• May increase sales³ |
| De-lamping | • Best annual cost and C02 savings  
• Reduces maintenance costs¹ |
| Compressor Control | • 3rd best cost and C02 savings  
• Extend machine life³  
• Reduces maintenance costs² |

 Recommendations
We recommend installing LED lights into the Next Generation machines and compressor controls into the Coke machines. Installing LED lights has almost no downside. Although it provides modest savings of just $39, there are minimal downsides. In addition, we recommend installing compressor controls. Though the payback period for this option is three years, it is the best option in terms of cost savings and feasibility. The two options combined provide cost savings of $4,043 and carbon dioxide savings of 31 tons annually.

The BC Administration should also look into shutting down some machines in high volume vending areas to even further reduce energy costs.

References