EFFECTS OF BUS IDLING AT RUTGERS UNIVERSITY
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Abstract
An analysis of Rutgers bus system was conducted to understand its environmental and economic impact. Data pertaining to bus specification and operation schedule was obtained from Rutgers Department of Transportation Services (DOTS) and upon evaluation, was estimated that bus idling during drivers’ breaks consumes $24,637 in fuel and produces 89.5 tons of CO2. Future direction looks to use the app TransLoc-Rider to more accurately track the length and frequency of idling time along with using its interface to assist with route planning. With proper maintenance and a new protocol, bus idling at Rutgers can be limited at minimal cost.

Background
Rutgers University is home to the second largest bus system in New Jersey; largest of all universities in the U.S. With fourteen routes peaking up to fifty-three buses a day, Rutgers’ bus system has a large presence in the environment it operates in. Figure 1 outlines the number of buses used on a daily basis between Monday and Thursday.

Results
Calculations are based on Rutgers’ academic calendar and do not include summer and winter sessions. Important parameters used: HVAC system operates at 3.24 kW, efficiency of engine-alternator system is 21%, and idling consumption is estimated at 0.97 gal/hr [3]. Upon calculations Rutgers pays $24,637 in wasted fuel and produces 89.5 tons of CO2 - equivalent to 20 cars operating annually.

Methods – Energy Assessment
The fuel distribution of Rutgers buses is 83% B20 and 17% diesel. A work order obtained by Eldorado-California identified the engine model, HVAC system and bus dimensions used in energy calculation. Metrics pertaining to the fuels’ heating values and chemistry were found using reference 1. Since the HVAC system is used continuously, its energy consumption is found using idling hours. Weather data was also analyzed to determine when the bus can practically be turned off.

Future Direction
TransLoc-Rider is an application that live tracks the position and timing of buses at registered stops. With Python, this data can be extracted to determine idle times longer than a minute, which can help calculate fuel consumption and CO2 emissions more accurately.

TransLoc-Rider can also allow drivers to see the location of other buses along their route. This can help improve communication amongst drivers, limit congestion at stops, and space buses more evenly. A phone-dashboard setup can be incorporated to allow this feature to be used responsibly by drivers.

Discussion
Implementation of this recommendation requires buses being turned off while drivers are on breaks. Interior and exterior heating will still be operational, however the HVAC system will not. To limit the change in the cabin temperature, only the front door of the bus should be left open. When assuming a 25% loss of air to the environment, the HVAC system should be turned on when the outside temperature is ±20°F the desired cabin temperature to prevent a variation greater than 5°F.

As the buses run on diesel, they use compression ignition, resulting in little wear and tear from more frequent startups. They are also outsourced, meaning fuel savings do not directly benefit Rutgers, however a reduction in emission around campus is an incentive since no capital cost come from implementation.

Calculations also assumed a ten minute break per shift based on information provided by DOTS, however the frequency is predicted to be higher and can be verified using coding with the TransLoc-Rider app. Integration of TransLoc-Rider shows great potential in increasing overall efficiency of the bus system.

References