

Grant Module

This work was produced by undergraduate students in the Worcester Polytechnic Institute (WPI) Global Projects program.

Red Bike Program

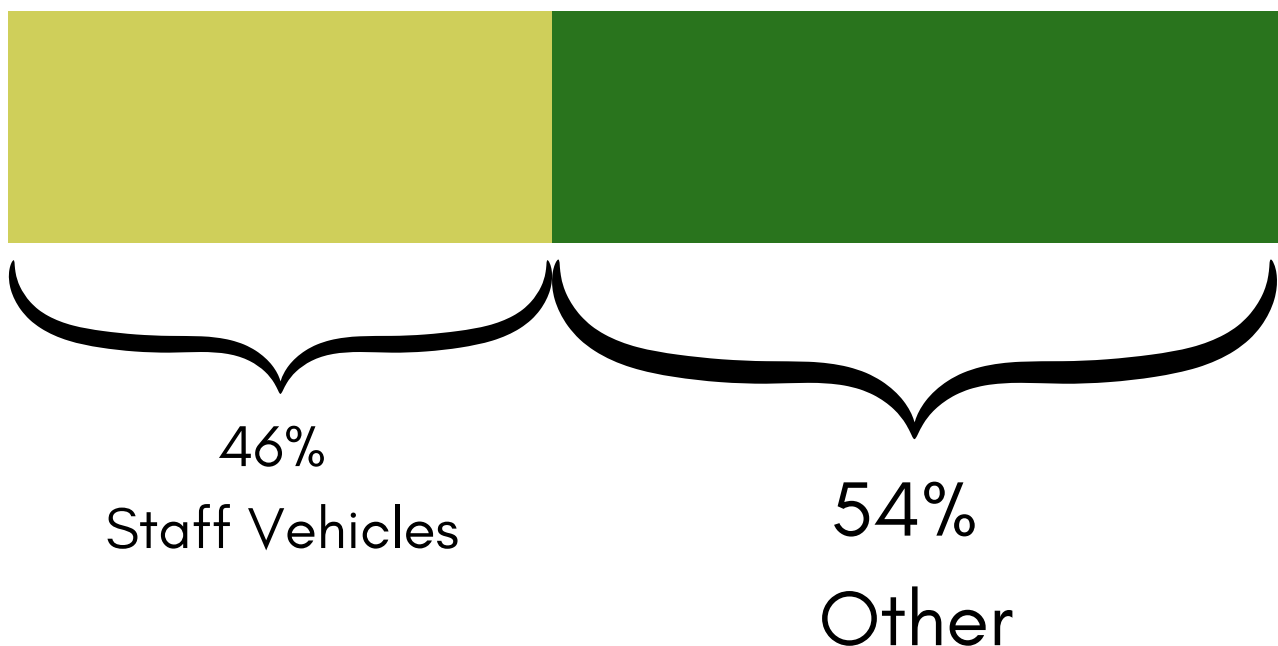
The Red Bike program in Glacier National Park is the current bike share program made up of 27 bikes available to staff in all areas of the park. The Red Bike Program is mostly used by staff who live in the headquarters area and commute to Apgar along the three-mile trail of mostly flat and paved terrain. These bikes are heavy, single-speed, have coaster brakes, and lack the capacity to carry cargo on the bike or in an attached trailer. This fleet is rapidly aging. Many of the bikes were purchased in 2003, with others in 2008.



GLAC Large Vehicle Greenhouse Gas Inventory

In January 2023, Glacier National Park completed a Greenhouse Gas Inventory that showed that staff park vehicle emissions contributed to 46% of the 2,800 metric tons produced by park operations in 2022 (T. Carolin, personal communication, September 5, 2023).

GLAC Greenhouse Emissions



Carbon Commitment

Glacier National Park is making strides to reduce carbon emissions. One of the main benefits of an e-bike fleet service in Glacier National Park could be the reduction of large vehicle use. Under executive order EO 14057, Glacier National Park has a goal to reduce its CO2 emissions by 65% by 2030 and achieve net 0 by 2050 (The White House, 2021). Holly Riffe, Supervisory Dispatcher, informed us the park also wants to replace all gasoline-powered light-duty trucks and cars with electric versions by 2030 (H. Riffe, personal communication, September 7, 2023).

**Reduce carbon
emissions by
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**Goal to Acheive
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Environmental Impact of E-Bikes

Table 1

Emission Analysis of transportation options in Glacier National Park

| Avg Emissions (g/km) | Electric Bike | Traditional Bike | Walking | Electric Car | Gasoline Car |
|----------------------|---------------|------------------|---------|--------------|--------------|
| Manufacturing | 7 | 5 | 0 | 49 | 42 |
| Rider Emissions | 6.3 | 16 | 56 | 0 | 0 |
| Electricity/Fuel | 1.5 | 0 | 0 | 48 | 229 |
| Total | 14.8 | 21 | 56 | 90 | 271 |

Note. "Manufacturing" represents initial carbon emissions divided by the average lifespan of the product. "Rider Emissions" represents carbon emissions produced by humans. "Electricity/Fuel" represents carbon emissions produced by using the product (Stott, 2020).

E-bikes have the lowest average emission rate of every method of transportation currently available for GLAC. This makes them a good potential alternative to large vehicle use, especially for short distances because they have a greater efficiency than walking or traditional biking.

Battery Care

Table 2

Safe Battery Temperature Ranges

| State | Temperature Range |
|------------------|-------------------------------|
| Discharge or Use | -20°C to 55°C (-4°F to 131°F) |
| Charging | 0°C to 46°C (32°F to 115°F) |
| Storage | -6°C to 35°C (21°F to 95°F) |

Note. This table represents the temperature of the battery in each state, when it is in use, being charged, and being stored.

Table 2 shows the circumstances and temperatures in which lithium ion batteries are considered safe.

Discharging is a state in which the battery is being used (Senior, 2022). Charging is a state in which the battery is not in use and is being charged from an external power source. Storage is a state in which a battery is not being charged or discharged (Senior, 2022). The listed temperature represents the actual temperature of the battery, not the temperature of the environment. When charging or being used, the battery is generating heat. Heat is produced because the chemical processes in the battery are not totally efficient. These numbers represent the safest temperatures for each state of an e-bike battery. When a battery is charged, stored, and used in these ranges, it could preserve the lifespan of the battery.

Use Cases



Volunteer Bike Patrol

We asked Jenny Hvizdak, the Wilderness Volunteer Coordinator in GLAC about possible e-bike use. She told us five to six volunteers are deployed into the park at one time and some of them have expressed that they would like to use e-bikes. The volunteer bike patrol could use e-bikes to patrol a larger area of the park, interact with more visitors, and respond to incidents faster.

Interpretive Staff

Matt, an interpretive staff member, provided multiple use case scenarios such as traveling to guided hike trailheads, headquarters to Apgar, and Apgar Visitor Center to Lake McDonald boat launch (Interp staff member, interview, September 27, 2023). All 5 of the interpretive staff we interviewed lived in the park and commuted to their work sites (S. Houston, interview, September 28, 2023).

Law Enforcement

Law enforcement has identified an opportunity to use an e-bike fleet for patrol around the park. During the summer, e-bike patrol units could decrease the car traffic on the GTSR. Our sponsor, Phil Wilson stated **"People are much more open to approaching an officer on a bike than a patrol car"** (P. Wilson, personal communication, August 29, 2023).

PSAR

E-bikes could aid in patrolling certain areas, particularly during hiker-biker season. Some staff members participating in PSAR currently use patrol vehicles, but e-bikes would reduce large vehicle use within the park and make patrollers more approachable. Additionally, e-bikes could enable a quick response time to dangerous incidents (P. Wilson, personal communication, September 5, 2023).

Backcountry Permit Staff

Brian McKeon, Wilderness Permit/AIS Prevention Programs, Right-of-Way and Academic Fee Waiver Coordinator, said that the wilderness permit staff currently use bikes to commute between their housing near headquarters and the office in Apgar. McKeon expressed that e-bikes would not be helpful for them beyond the commute, as bikes aren't allowed in the backcountry (B. McKeon, personal communication, September 20, 2023).

Scenic River Shuttle

A use scenario brought up by Kate McHugh and Jillian McKenna was for transportation to the river shuttle launch location. Currently, the patrol unit takes two cars up to the launch site, but they proposed using one or two e-bikes instead of one of the cars. She also told us that the River Ranger Volunteer Program is **"a constant battle with vehicles,"** stemming from changing road conditions. She said that adding all-terrain e-bikes to their operations **"would be really awesome,"** because it would make patrolling easier (J. Hvizdak, personal communication, September 20, 2023).

Grants

Previous Grants

In May 2023, the Green Team submitted a grant to the Glacier National Park Conservancy for \$40,000 to buy 22 e-bikes and extra utility accessories. However, the Conservancy rejected this proposal due to concerns about e-bike safety (J. Belt, personal communication, September 7, 2023).

Grant Recommendation

One approach to increase the likelihood of grant approval is starting small. The previous grant asked for 22 e-bikes and gear totalling \$40,000. A new grant requesting five to ten bikes and necessary accessories might be more favorable to Conservancy donors.

