

E-Bike Comparative Analysis

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Comparative Analyses

The purpose of this document is to inform decision-making staff on various factors concerning e-bike purchasing. We included tables that explain various advantages and disadvantages of certain e-bike models, general pros and cons of bikes at three price points, and an overview of potential maintenance vendors.

Comparing E-Bike Models

Table 1: Comparison of Class 1 E-bike models

→ Comparing Class 1 E-bike models				
MODEL	USE	COST (RETAIL)	REMOVE BATTERY?	FEATURES
Scott Sub Sport eRide 20	Utility	~\$3900	Yes	Pannier rack, rear wheel lock
Kettler Traveller E-gold 5 Plus Belt	Utility	~\$3900	Yes	Pannier rack, rear wheel lock, drive belt
Aventon Pace 500.3 Step Through	Cruiser	~\$1599	Yes	Pannier mounting points
Specialized Haul ST	Utility	~\$2800	Yes	Pannier Rack, largest battery
Aventon Soltera Step Through Ebike	Hybrid	~\$899	Yes	Pannier mounting points

Table 1. The Scott and Kettler bikes are considered top tier e-bikes. The Aventon Pace and the Specialized e-bikes are considered to be middle tier e-bikes. The last bike has the lowest tier (Scott Bicycles, 2023), (Kettler Alu-Road, 2022), (Aventon Bikes, 2023), (Specialized, 2022).

All of the bikes compared are class 1 step-through bikes with pedal assist. These e-bikes are split into top, middle, and low tier options. The vendors we interviewed owned e-bikes with Bosch motors. They stated that these bikes had not had motor or battery malfunctions. Higher quality bikes also feature better safety features such as wheel locks that immobilize the bike if the key is not present.



Comparing Local E-Bike Vendors

Table 2: Local Service & Vendor Comparison

 Local Service & Vendor Comparison			
Comparing E-bike sales & Repair Shops			
VENDOR	BUSINESS MODEL	ARE YOU OPEN TO MAINTAINING A NEW FLEET?	LOCATION
Sky Eco	Rentals	No	Coram
A7 Cyclery	Maintenance, Sales	Yes, We service Glacier Outfitter's fleet	Columbia Falls
Montana E-Bikes	Sales, Rentals	Yes	Whitefish
Glacier Outfitters	Rentals	No	Apgar Village

Table 2. Provides information about vendors interviewed and their specialization.

We interviewed four vendors whose specializations included rentals, sales, and maintenance. Our questions involved gathering information about their experience with e-bikes and potential interest in supplying and maintaining an e-bike fleet for GLAC. We were referred to Glacier Outfitters in Apgar Village by Jenny Hvizdak because they occasionally hire maintenance engineers. Since they didn't hire an engineer this year, they were not interested in doing fleet maintenance. A7 Cyclery provides maintenance services to Glacier Outfitters (Lynn Foster, personal communication, September 26, 2023). According to Foster, their business would be up to the task of providing maintenance for a GLAC staff e-bike fleet. Montana E-Bikes is a rental and sales operation in Whitefish. They are an Aventon retailer and in our interview they expressed interest in supplying e-bikes to GLAC (Montana E-Bikes, personal communication, September 26, 2023). Sky Eco is a rental business just outside the park. They were not interested in supplying bikes or providing maintenance services.



E-Bike Tier Information

Table 3. Comparison of Class 1 E-bike models

→ E-bike Tiers

Comparing e-bike price points

TIER	ADVANTAGES	DISADVANTAGES	NOTES
High	Crank motor, reliability, serviceability	Purchase price	Less maintenance cost, unique security features
Middle	Utility	Lower tier drivetrain components	Lack crank motors, good middle ground
Low	Purchase cost	High maintenance costs, low end components	Lack hydraulic disc brakes and out of the box utility racks

Table 3. Explains different tiers of e-bikes and their advantages and disadvantages (Scott Bicycles, 2023), (Kettler Alu-Road, 2022), (Aventon Bikes, 2023), (Specialized, 2022).

There are key aspects of each tier highlighted in our comparison. Both high tier bikes featured crank motors. Crank motors provide assistance at the bike's pedals. The main advantage of crank motors is their characteristically smooth assistance. All other bikes have motors which are positioned on the hub of the back wheel, meaning the gear a rider selects has no bearing on how the motor provides assistance (Chawrasia et al., 2021). Lower-tier bikes also have less expensive, lower end drivetrain equipment. Drivetrain components are items such as the derailleurs, brakes, shifters, chains, and cranks. Lower-tier components are less serviceable and user friendly (Ayachi et al., 2015). An example of an inferior component would be mechanical disc brakes versus hydraulic disc brakes. Hydraulic disc brakes work much like the ones in a motor vehicle; a hydraulic fluid is compressed by the brake lever and the pistons squeeze pads which make contact with the brake rotor (Dong et al. 2019). Mechanical disc brakes work similarly, replacing the fluid with a cable. The problem arises when the cable becomes stretched and maximum braking force is unavailable (Oliver et al., 2017).



Maintenance of E-Bikes Compared to Traditional Bikes

We found that maintenance on e-bikes does not differ much from traditional bikes. The most common maintenance for e-bikes are brake pads, tires, inner tubes, and chains (Sky Eco fleet manager, interview, September 13, 2023). These are common fixes in both traditional bikes and e-bikes. Brake pads on e-bikes wear faster due to the bike's heavier weight. The chain may wear faster as well due to the fact that the motor has high torque. E-bike chains typically last 2000 to 3000 miles, about a thousand miles less than on a traditional bike (J. Houser, interview, September 26, 2023). As with any bike, checking that bolts and fasteners are tight is important for safety. Chain lubrication ensures the e-bike is operating efficiently and prolongs the life of the chain and any associated drivetrain components (Sky Eco fleet manager, interview, September 13, 2023). A tire that is underinflated may develop a flat, along with having reduced efficiency. A tire that is overinflated will result in unpredictable behavior such as sudden loss of traction. Tire pressures could be checked at the same time as chain lubrication. Battery replacement could also be performed as needed. E-bike batteries last between 500 and 1000 charge cycles. A charge cycle is charging from 0% to 100% and then discharging back to 0% (Onda et al., 2006). For example, if an e-bike were ridden five miles per day and charged every ten days, the battery could last up to 26 years. A full charge on an e-bike lasts 50 miles on average. Many e-bikes have a state of charge estimate, however the displayed charge percentage cannot always be relied upon.

For rental e-bikes, maintenance is estimated to be about \$100-150 a year, not including labor costs. For a fleet in Glacier National Park, this maintenance cost might be less as these bikes might be ridden less often than rental bikes (Sky Eco fleet manager, interview, September 13, 2023).

There may be fewer maintenance and safety issues with e-bikes provided that staff are careful with them. Some staff members reported that they expected GLAC personnel to be much more conscientious with their riding habits and safety than visitors (S. Houston, interview, September 28, 2023).



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