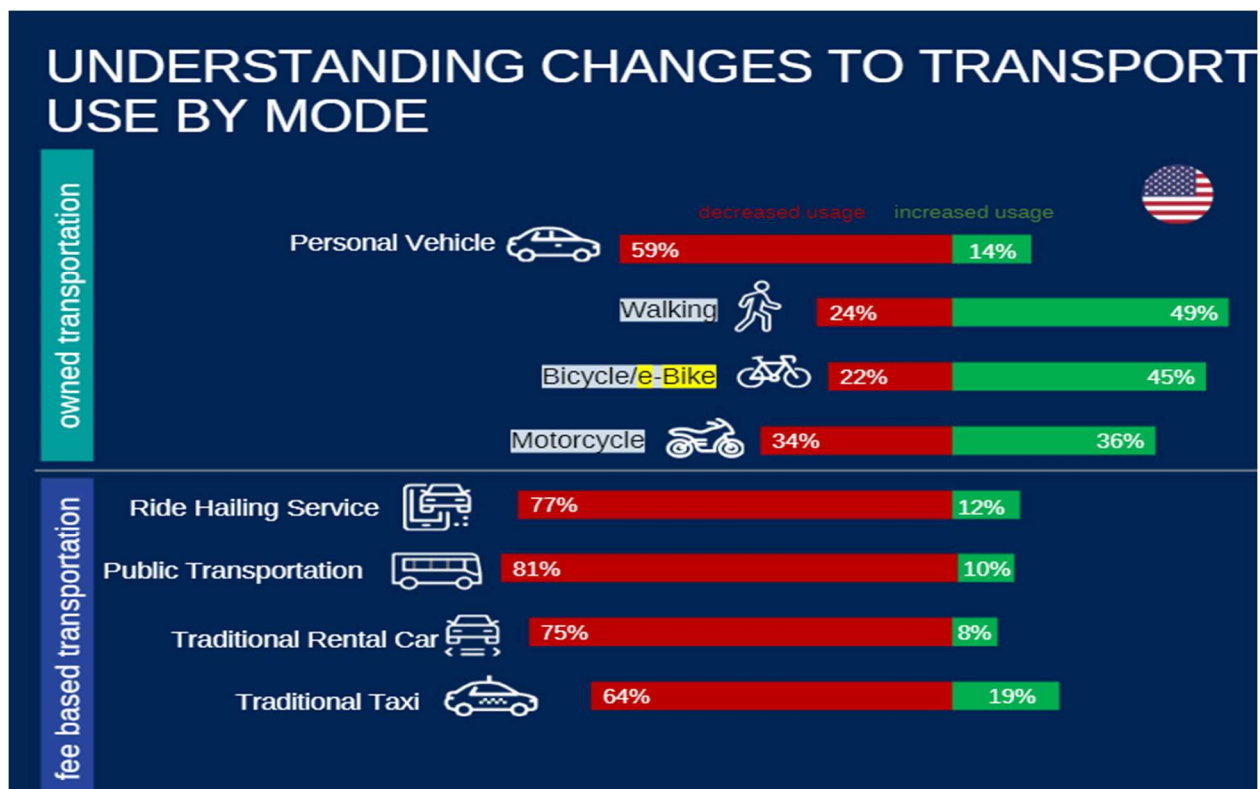
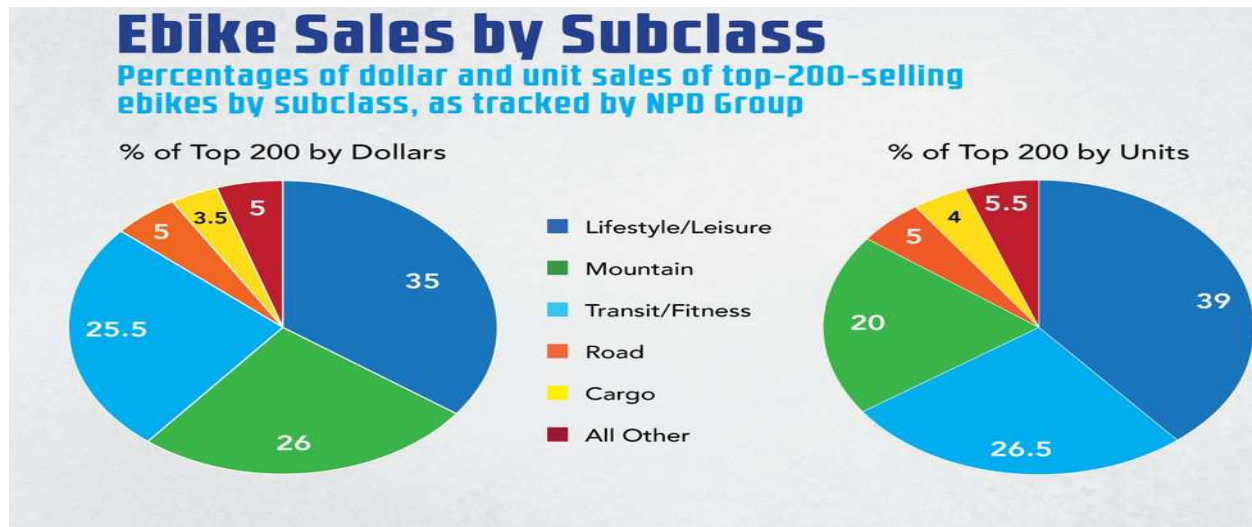


Riding the Trend of E-Bikes and Micro-Mobility: Investment Primer

E-bike's have been around for a long time but over the last few years saw strong sales growth in Europe & Asia, and now the US is seeing a surge in growth, partially due to the pandemic accelerating a number of favorable trends. An e-bike, also known as electric bicycle, is a type of bicycle that has an electric motor. The motor is used for either assisting the rider's pedal-power or completely moving the bike on electric power. Electric bicycles use rechargeable batteries to power the motor, do not emit CO2, and travel at speeds ranging from 20 to 30 mph. The electric bikes mainly use Li-ion chargeable battery and have a maximum of 99.4 miles (160 km) in one single charge, although there is an opportunity for fuel-cell powered e-bikes. The changes to transport since the pandemic can be seen below.



E-bikes are gaining popularity not only for recreational use, but also as a main of commuting, city transport systems, and B2B/B2C delivery. There are a number of advantages to rising e-bike usage including being favorable for the environment, cheaper than other means of transportation, eliminating traffic, low maintenance and easy to store/transport. The pandemic has also accelerated the adoption of e-bikes with public transport health concerns and state subsidies are also boosting the business. Rising global emission level concerns has governments supportive of electric-transportation, a trend unlikely to change.

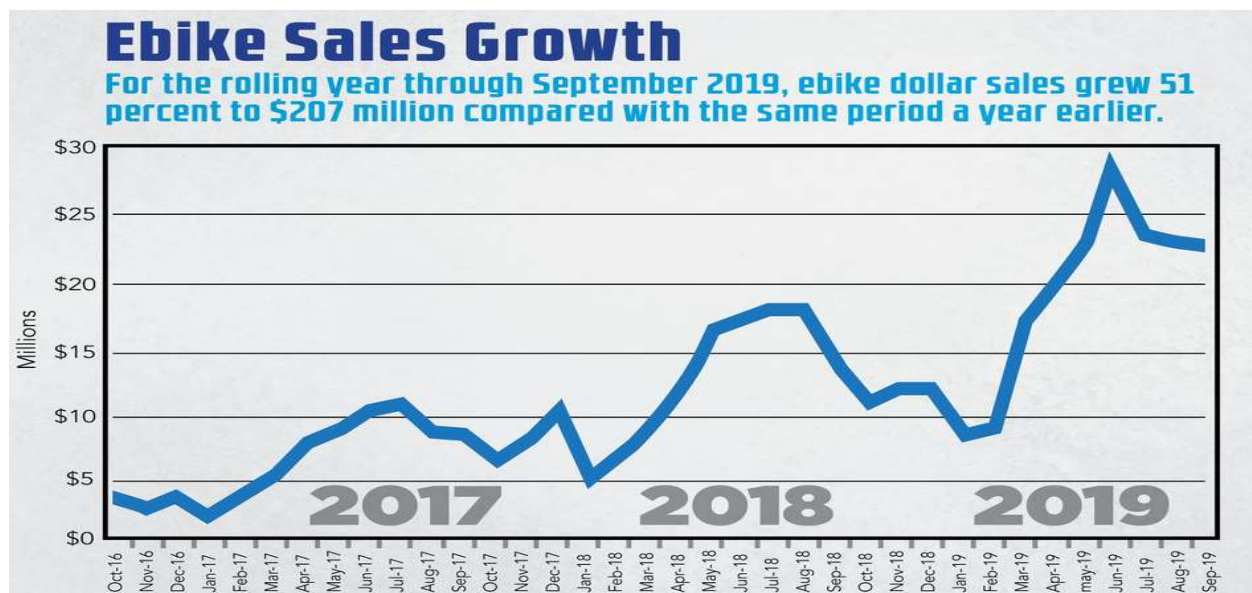


Cycling point-of-sale data for rolling year through September 2019. NPD Group

The global electric bicycle market is expected to reach \$21B by 2024 growing a 12.5% CAGR, according to an average of various market research reports. The growth is expected to be supported by a rising consumer preference towards recreational and adventure activities. The e-bike market in North America is projected to be the fastest-growing market at a CAGR of 19.77%.

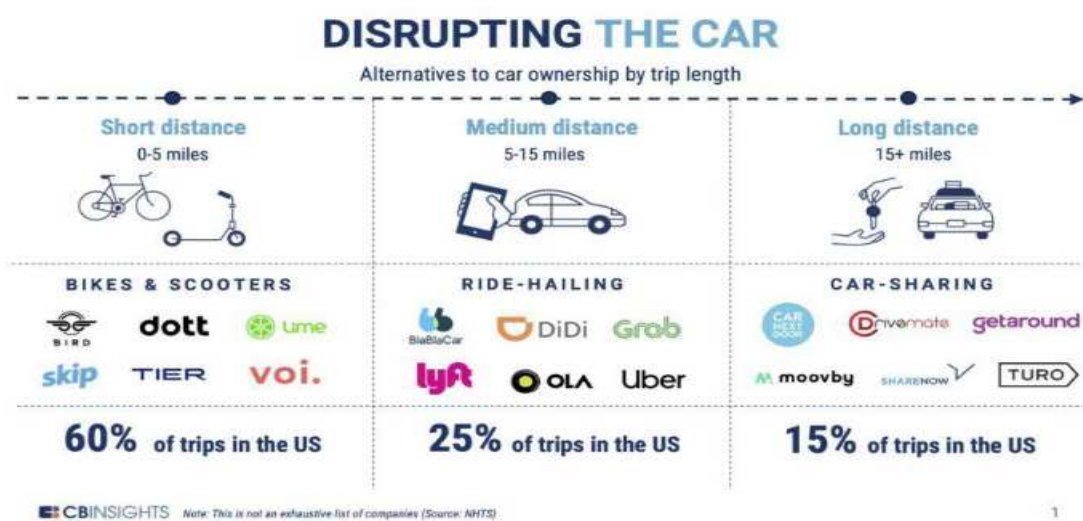
I recently wrote on the revival of the outdoor recreation market

(<https://www.cmcmarkets.com/en-au/opto/how-to-invest-in-the-revival-of-the-great-outdoors>).

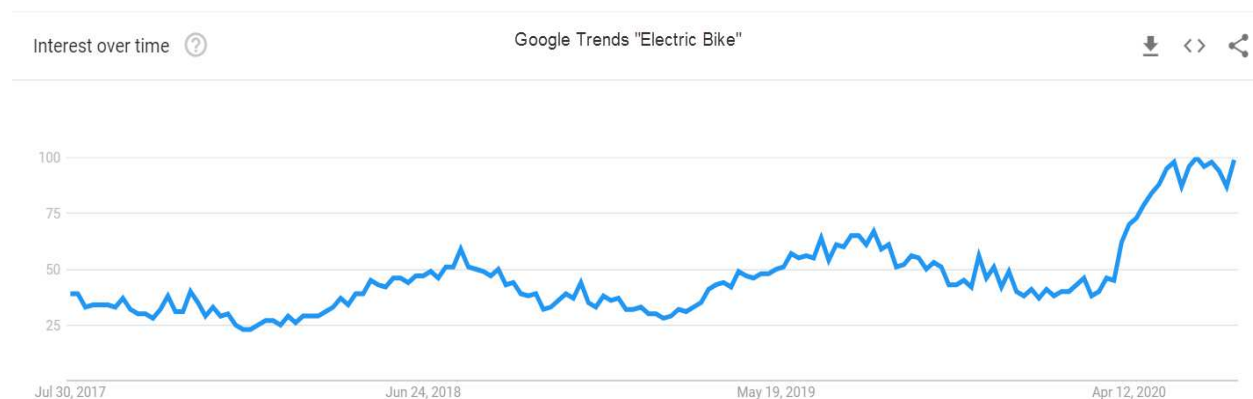


Other factors such as logistics and rental services are also supporting growth. The versatility has a lot of consumer appeal for recreation and fitness as well as an alternative to short trips for commuting or shopping. The market is also seeing strong growth in high-performance e-

mountain bikes and continuous innovation and improvement in technologies will make e-bikes even more appealing to consumers. There have already been breakthroughs in Lithium-Ion technology allowing for lighter, more efficient bikes with a greater travel range. I also expect connectivity and integration of performance tracking to support the appeal for new bikes. We are already seeing predictive analytics, 3D-printed parts, electrification and wireless connectivity advancements making the biking safer, faster and more convenient. E-bikes are also less intimidating with the pedal-assist resulting in less sweating/energy expenditure for those wanting to commute to work, and the majority of Americans commute less than 13 miles to work. In terms of safety the bikes also have high powered LED lights for night-riding and can be locked, secured, and tracked via apps.



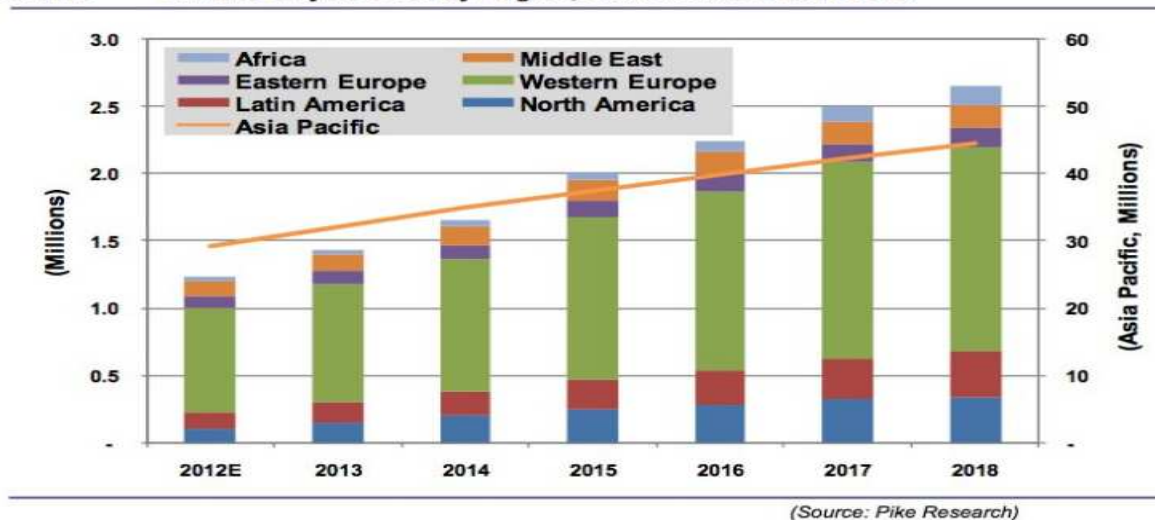
Below I used Google Trends to see search trends for electric bikes.



Europe and Asia have already seen greater adoption and North America is now starting to see a major surge in sales. NPD recently noted that US retail sales of e-bikes rose 84% in March, 92% in April and 137% in May and this following Q1 2019 Y/Y growth of 90%. Bosch eBike Systems recently noted customers in the US are setting sales records and expects the trend to continue

as an ideal solution for individual transportation, and sees it continuing well past the corona-era. A few notable US e-bike companies have also reported numbers; Aventon Bikes saw a 600% increase in bike demand in June and Rad Power Bikes said demand was up nearly 300% in May. It is projected that by 2023, there will be 34 million electric bikes used in the metropolitan transportation landscape according to Navigant Reports, in an effort to satisfy the growing need of urban mobility via clean energy.

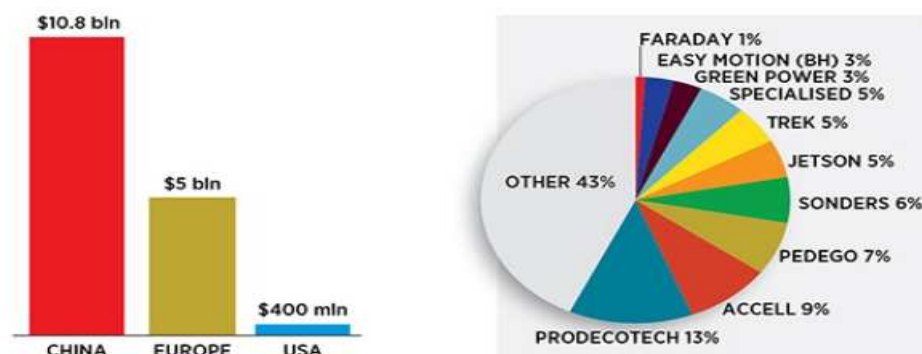
Chart 1.2 Electric Bicycle Sales by Region, World Markets: 2012-2018



The e-bike market is highly fragmented, with the major players holding a low share of the total market share. Some of the major market players are Giant Bicycles, Merida, Trek Bikes, Riese & Muller, and M1 Sporttechnik.

BIKE PEDDLERS

The global e-bike market is big, but the US's share is small and fragmented among many players

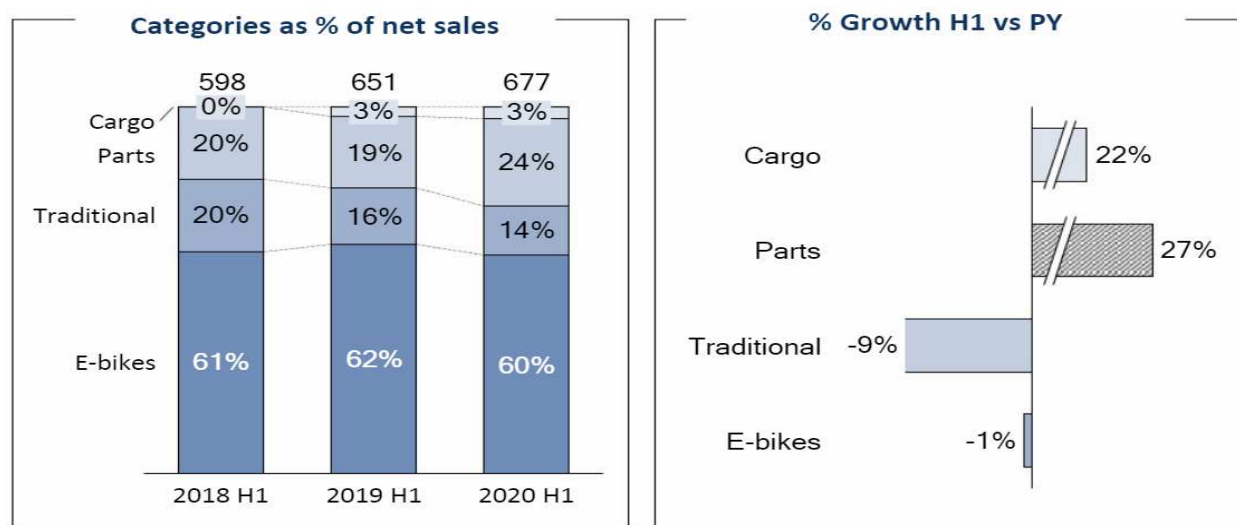


In terms of investing in this emerging growth trend there are not a lot of pure-play ways to participate, and as previously discussed the bike maker market is highly fragmented and mostly private companies. There are a number of private companies and may see M&A and IPOs in the

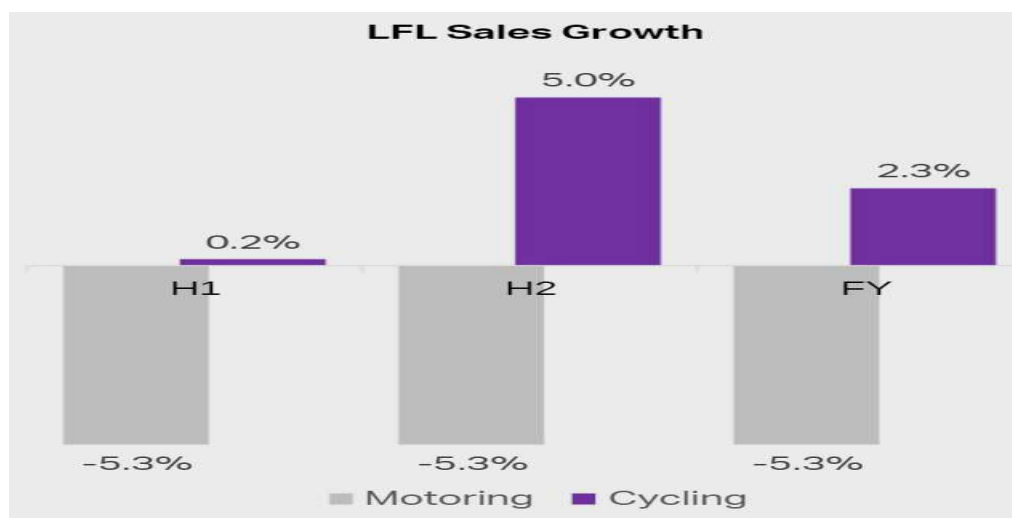
next few years offering investors more options. However, with some deeper research and scouring company reports there are a number of ways to participate in the e-bike trend, which also applies closely to the growing e-scooter market as well. Below are some of the ways to play these markets by breaking down the bike components.

Bike Makers

Accell Group (ACCEL:NA) is a Netherlands-based bicycle company that did \$1.24B in revenues in 2019. They own the bicycle brands Atala, Babboe, Batavus, Carraro Cicli, Ghost, Haibike, KOGA, Lapierre, Loekie, Nishiki, Raleigh, Sparta, Torker, Tunturi, Van Nicholas, Winora, and XLC components. It recently launched its next-generation e-cargo bike Carqon.



Halfords Group (HFD:LN) is a British retailer of car parts, car enhancement, tools, camping and touring equipment and bicycles. HFD did \$1.47B in revenues in 2020 and its latest update showed growth in the Cycling segment.



Giant Manufacturing (9921:TT) is a Taiwanese bicycle manufacturer, recognized as the world's largest bicycle manufacturer. It expects \$2.33B in revenues in 2020, up 13.5% Y/Y.

Merida Industry (9914:TT) is another Taiwan-based maker of bicycles with revenues seen at \$1.06B in 2021, +14.2% Y/Y.

BYD Co (1211:HK) is a Chinese maker of automobiles and battery-powered bicycles and other means of transportation. BYD expects \$19.95B in revenues in 2020, up 13.2% Y/Y.

Peloton (PTON) is a high growth company that falls more into the fitness bike category, but worth noting as a related company, and one with a massive growth opportunity.

Bike Components

Shimano (7309:JP) is a Japan-based maker of bicycle components expecting \$3.55B in revenues in 2021, +11.5% Y/Y.

Fox Factory (FOXF) is a favorite small-cap name that makes various components for outdoor recreation and 40% of its sales are tied to bike components.

Vista Outdoor (VSTO) makes a variety of outdoor products, more closely tied to hunting/shooting, but does have exposure to bike helmets.

Allegion (ALLE) is a maker of a variety of doors and locking components, and has exposure to e-bike lighting and locking systems.

G4S (GFS:LN) is a security company seeing growth in its tracking systems for e-bikes.

MIPS AB (MIPS:SS) is a global leader in the making of helmets and has seen a recent demand surge in bike helmets in the US and Europe.

Thule Group (THULE:SS) is a maker of cargo accessories and has noted that e-bikes being heavier requires higher quality bike racks, which it makes, and seeing strong demand for these systems.

Invacare (IVC) was an intriguing discovery, more known for its exposure to the Healthcare industry with wheel chairs and senior citizens scooters, but also makes e-bike drive systems for superior driving performance.

Rheinmetall AG (RHM:GR) is an Industrial with exposure to automotive and defense markets, but does make engineer support systems for e-bikes.

Continental AG (CON:GR) is a worldwide leader in tires that has noted strong demand for e-bicycle tires.

E-Bike Sharing

Uber (UBER) and **Lyft (LYFT)** both have bike-sharing initiatives.

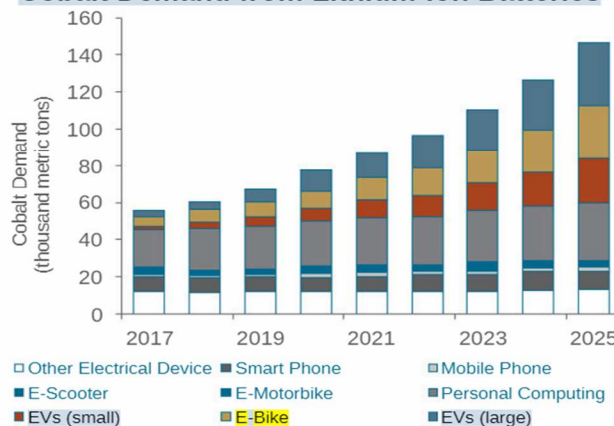
Batteries

Another way to play the overall electrification and battery trend is via the suppliers. **AlbeMarle (ALB)** is the leading Lithium supplier. **Sociedad Minera (SQM)** is another leading lithium producer. **Lithium Americas (LAC)** is a small lithium exploration company. **Livent (LTHM)** is a smaller producer of lithium based batteries. There is also a **Lithium ETF (LIT)** that one can invest. **Wheaton Metals (WPM)** has Cobalt exposure that is seeing strong demand from Lithium-Ion batteries. **O2 Micro (OIIM)** is a small and speculative \$57M Company with patented lithium-ion cell balancing methodology that sees opportunities with major OEMs in power tool, e-bike, e-vehicle, vacuum cleaners, garden tools and energy storage systems. It recently noted “While we believe each of these market areas will continue to expand long term, we are seeing the e-bike market now show significant expansion in countries recovering from COVID-19 as people turn more to bikes for travel and recreation.” **Johnson Matthey (JMAT:LN)** makes battery materials, recently with 16% growth noting continued momentum in Fuel Cells and Battery Systems for e-bikes.

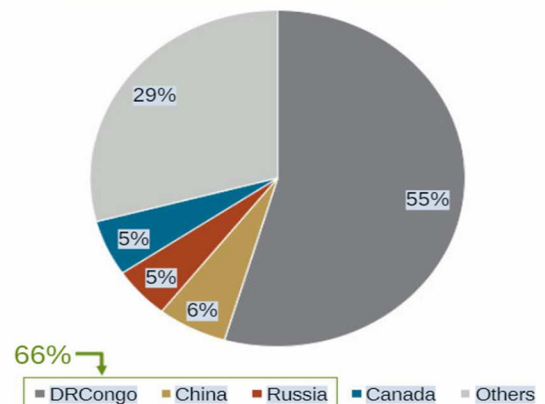
COBALT

A PRECIOUS BASE METAL – STRONG FUNDAMENTALS

Cobalt Demand from Lithium-Ion Batteries^{1,25}



Cobalt Production by Country²⁶



The e-bike of the future may utilize hydrogen fuel-cells which can provide longer ranges and faster refueling. A few names in this fuel-cell industry to watch include **Plug Power (PLUG)**, **Ballard Power (BLDP)** and **Bloom Energy (BE)**.

Chips and Sensors

There are a number of chip companies that are likely to have some exposure to e-bikes in the future but a few that stood out based on recent commentary include **ST Micro (STM)** as a maker of battery design systems, **Power Integrated (POWI)** as a power supply chip-maker, and **Diodes (DIOD)** and **Method Electronics (MEI)** for sensors and connectors.

In closing, E-Bikes is just starting a longer-term cycle of growth in my view and there will be plenty of beneficiaries. I am certain the list above is not complete and will continue to research and pay attention to commentary in this exciting market. I may even consider putting together a basket for the E-Bike and Micro-Mobility theme in the future.