



Battery Manufacturers

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Table of Contents

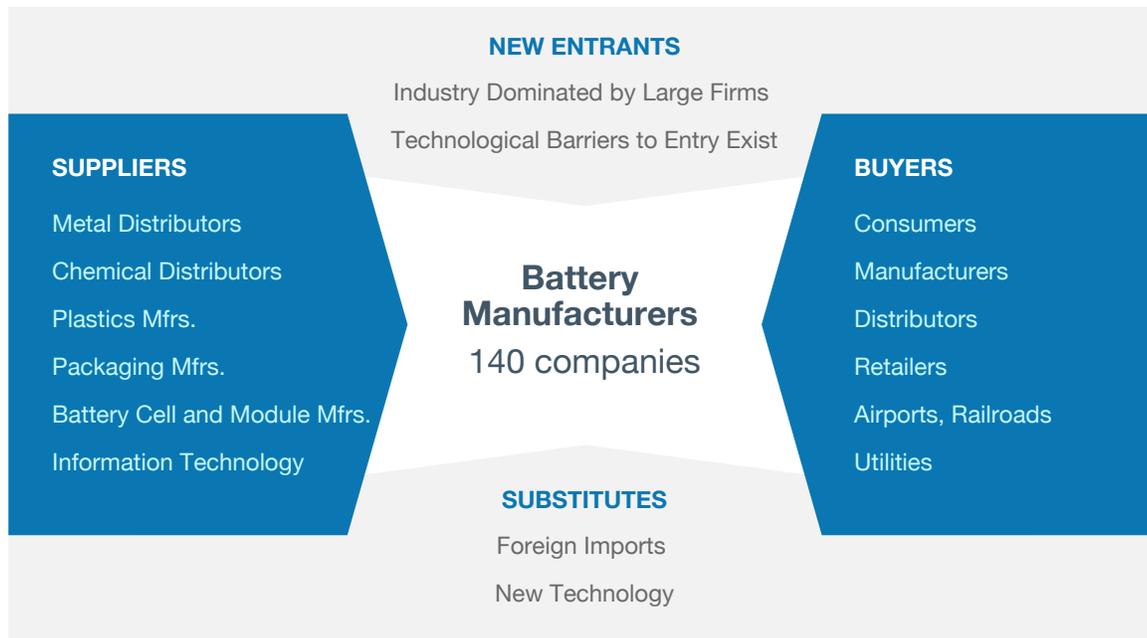
1. [Coronavirus Update](#)
2. [Industry Structure](#)
3. [How Firms Operate](#)
4. [Global Perspective](#)
5. [Industry Trends](#)
6. [Credit Underwriting and Risks](#)
7. [Industry Forecast](#)
8. [Working Capital](#)
9. [Capital Financing](#)
10. [Business Valuation](#)
11. [Financial Benchmarks](#)
12. [Quarterly Insight](#)
13. [Call Prep Questions](#)
14. [Industry Terms](#)
15. [Web Links](#)
16. [Related Profiles](#)

Coronavirus Update

Apr 21, 2021 -- Expected Consumer Spending Surge may Boost Demand

- Demand for batteries used in consumer products is likely to increase if an expected post-pandemic surge in consumer spending is realized. Bloomberg Economics estimates that consumers have amassed about \$1.7 trillion in savings since the beginning of the pandemic through January. That's being bolstered by a new round of stimulus payments. Consumer spending during Q2 and Q3 2021 is likely to be the strongest such period in at least 70 years, according to economists at financial services firm Wells Fargo.
- Input shortages are increasing for many firms partly because of pandemic-related congestion in freight transportation networks. A pandemic-driven shift in consumer purchasing habits from experience purchases to consumer goods purchases, particularly for the home, led to a dramatic increase in imports from Asian manufacturing centers, according to The Detroit News. The increase in imports resulted in backups at overwhelmed ports and freight hubs across the US. Businesses of all types are now forced to wait months instead of the usual weeks for deliveries, and no one knows when the situation will be resolved. The Fitch Ratings credit ratings agency said in its 'Fitch Ratings 2021 Outlook: US Transport' that the coronavirus pandemic will continue to be an impediment, even though performance will improve in 2021.
- Some battery manufacturers are likely to benefit from the one-year extension of the 30% credit for installing electric vehicle chargers that was included in the federal stimulus package passed in December 2020. The credit is capped at \$1,000 for home installations and \$30,000 for businesses. The stimulus package also extended the 10% credit for two-wheeled plug-in electric vehicles, capped at \$2,500 per vehicle.
- Some communities are developing plans to capitalize on pandemic-driven attempts to re-shore industries that have been identified as essential. Hickory, NC, has allocated \$90 million to attract these and other industries as part of a local revitalization plan. Targeted essential industries include battery manufacturing, pharmaceuticals, medical supplies and personal protection equipment, medical devices and testing equipment and products, medical and R&D labs, logistics and transportation parts and equipment, information and data storage, food production, and advanced textiles. Scott Millar, president of the Catawba County, NC, Economic Development Corporation, sees a trend, driven by the pandemic, for site selectors to opt for less densely populated areas instead of large urban metros.

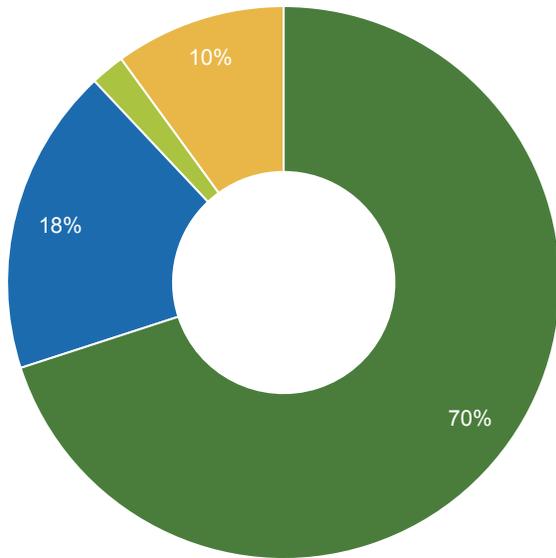
Industry Structure



The average battery manufacturer employs between 175 and 210 workers and generates between \$65 million and \$100 million annually.

- The primary battery manufacturing industry consists of about 40 firms that employ about 7,500 workers and generate between \$4 billion and \$5 billion annually. The storage or secondary battery industry consists of about 95 firms that employ 20,000 workers and generate between \$6 billion and \$7 billion annually.
- The industry is highly concentrated; the top 50 companies account for about 99% of industry revenue.
- Large firms with primary battery manufacturing capacity include Energizer, EnerSys, and Duracell (Berkshire Hathaway). Large global firms with storage battery manufacturing capabilities include LG Chem, CATL, BYD, Panasonic, and TESLA. Domestic firms, which include EastPenn Manufacturing, Exide Technologies, and New Power, typically have international operations.
- Many lithium-ion battery manufacturers are subsidiaries of larger companies, including auto and consumer electronics manufacturers.

Industry Demographics



- Corporations (70.0%)
- S-Corporations (18.0%)
- Individual Proprietorships (2.0%)
- Partnerships (10.0%)



Female Owned

12.0%



Minority Owned

5.0%



Veteran Owned

7.8%

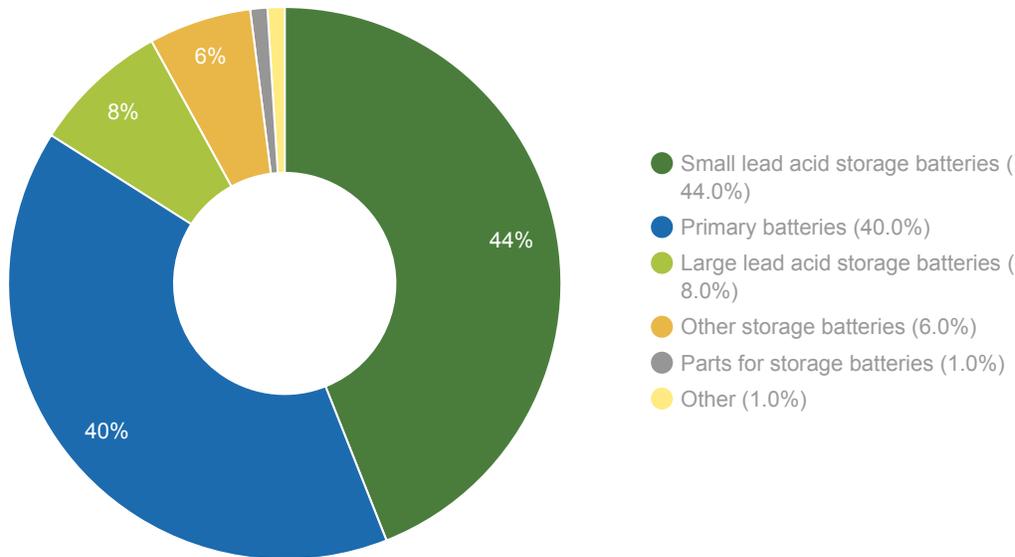
How Firms Operate

Products and Operations

Battery manufacturers produce power sources for household, commercial, and industrial use.

- Major types of products include storage batteries, primary batteries, and parts for storage batteries.
- Firms may sell related products, such as battery chargers, power equipment, lights, and battery accessories.
- Wet cell batteries draw power from a liquid electrolyte, while dry cell batteries rely on a mostly solid substance.

Battery Manufacturer Revenue



Storage or secondary batteries are rechargeable and found in consumer electronic devices (such as smartphones and tablets), vehicles and back-up power sources. Lithium-ion batteries are among the most popular rechargeable batteries, particularly for electrical vehicles (EV) and personal electronic devices. Nickel-cadmium batteries are heavier than lithium-ion batteries but provide similar performance.

Lead-acid batteries include starting batteries, like a car battery, and deep cycle batteries, which deliver a low, steady level of power and are used to power accessories. Dual-purpose batteries offer a combination of starting and deep cycle power. Motive batteries are used for industrial equipment and machinery, such as a forklift, which requires electrical power for the vehicle and its accessory. Standby lead batteries provide power to critical systems in the event of a power outage and include industrial batteries, which can provide low steady power over an extended period of time. Fuel cells convert chemical energy to electrical energy and are used to power satellites, space capsules, cars, boats, and submarines. Battery (or energy – ESS) storage systems use battery technology to store energy from a source, such as solar panels or a power plant, for use at a later time. Large scale battery storage systems have become part of US electrical grids.

Primary batteries are single-use products and cannot be recharged. Dry cell or zinc-carbon batteries are primary batteries, as are most alkaline batteries, which serve as replacements for dry cell units, but have more energy storage capabilities and less electrolyte leakage. Primary batteries are classified by size, indicated by letter (AAA, AA, C, D). Coin cell batteries are defined by two letters (chemical composition, shape) and four numbers (diameter, height). The Battery Council International (BCI) also defines groups of batteries by the physical dimensions of the battery case. Primary batteries are best suited for low-power devices, such as wall clocks or smoke alarms.

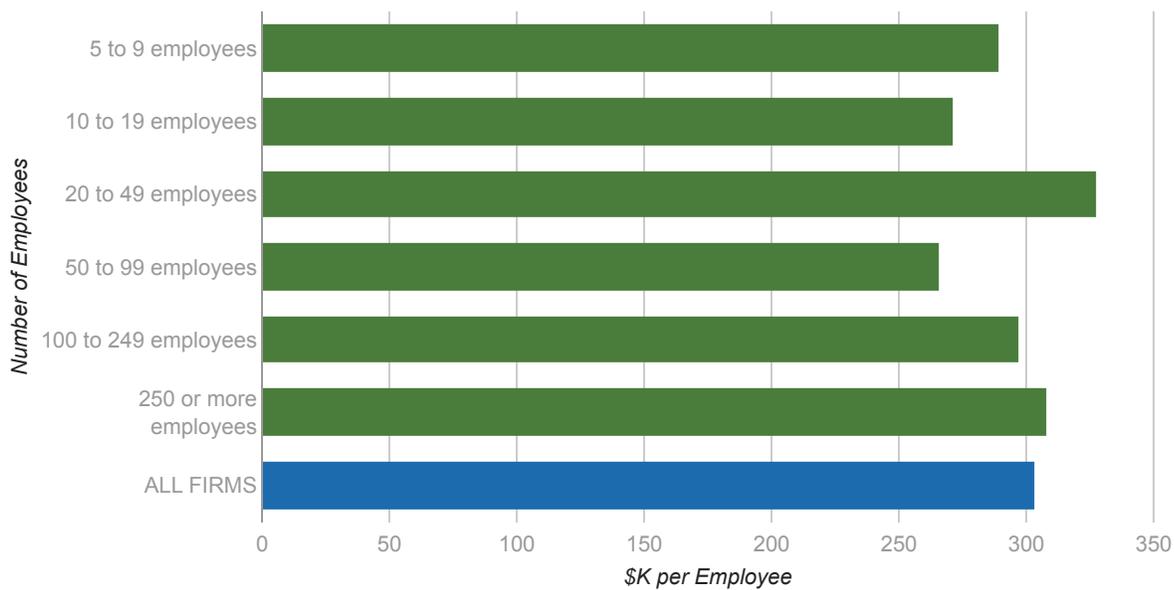
Primary raw materials include lead, lithium, manganese, zinc, silver, nickel, steel, graphite, copper, cobalt, electrolytes, and plastics. While raw materials and manufacturing processes vary by type of product, batteries are essentially groups of linked cells that consist of

anodes and cathodes (metals) and electrolytes. Cells produce electricity when one end of a cathode and one end of an anode are placed into an electrolyte that can conduct electricity, while their other ends are connected. Variations in raw materials affect the amount of electricity produced, the rate of production, the voltage at which electricity is delivered through the lifetime of the cell, and the cell's ability to function at different temperatures.

For electric vehicles, multiple cells are assembled to form larger modules, which are combined with electrical connections and cooling equipment by hand or using automated equipment to create a battery pack. Cell production, assembly, and packing processes may occur in different locations with different manufacturers. For example, the auto industry generally outsources cell production (primarily to Chinese, Japanese, and Korean manufacturers) and performs the module and pack assembly in-house, according to BCG.

The battery manufacturing workforce includes employees with manufacturing, distribution, and sales capabilities. Employees in research and development have scientific and technical expertise. Firms typically employ some unionized labor. Producers of industrial and commercial products typically employ or contract with staff to provide maintenance and customer support.

Revenue per Employee by Establishment Size



Profit Drivers

Maintaining High Capacity Utilization

Battery manufacturing is highly automated to efficiently produce high volume products. To achieve their gross margin targets, manufacturers must maintain high production capacity utilization in order to spread fixed costs over more units. Fluctuations in demand from customers can create challenges in maintaining capacity utilization while avoiding excessive inventory levels.

Successful Product Innovation

Battery manufacturers rely on innovative new products to attain revenue and profit goals. New battery technologies increase battery life, generate more power, provide faster recharging, and lower cost per output, particularly for storage batteries. Continued advances in battery technology is critical for high growth applications, such as electric vehicles and renewable energy storage. Commercialization of new battery technologies is a lengthy process involving many years of investment, so failures can be very costly and result in competitive disadvantage.

Improving Supply Chain Efficiency

Price-based competition, particularly for primary batteries, forces battery manufacturers to seek efficiency improvements throughout their supply chains. Firms negotiate volume purchase agreements with suppliers and may engage in hedging strategies to protect

against fluctuations in raw material prices. They invest in supply chain management and demand forecasting software to avoid excess inventories and out-of-stocks by their customers. Speeding production and delivery times can allow them to respond more quickly to changes in demand from customers.

Global Perspective

Global Market Size

The global battery market was valued at about \$108 billion in 2019 and is projected to see average annual growth of 14% through 2027, according to Grand View Research. In 2019, the Asia Pacific region accounted for one-third of the global battery market.

Large Companies

| COMPANY | HOME COUNTRY |
|--|--------------|
| Contemporary Amperex Technology Co., Ltd. (CATL) | China |
| BYD Company Limited | China |
| The Duracell Company | US |
| Energizer Holdings Inc. | US |
| Envision AESC Group | Japan |
| Exide Technologies | US |
| LG Chem, Ltd. | South Korea |
| Panasonic Corporation | Japan |
| Samsung SDI Co., Ltd. | South Korea |
| Tesla, Inc. | US |

Key Global Trends

Falling Battery Prices – Producer prices for lithium-ion batteries have fallen dramatically in recent years as so-called battery gigafactories (primarily in Asia) achieved economies of scale and manufacturing technologies have improved. Lower battery prices will help drive down the cost of electric vehicles (EVs) and storage batteries used in electricity grid applications, which will accelerate adoption rates for both and further increase global battery demand. Between 2010 and 2017, lithium-ion battery prices fell from about \$1,000 per kilowatt-hour (kWh) to just over \$200 per kWh, according to Bloomberg.

Electric Vehicle Growth – Compared to 2018 levels, by 2025 the market value of electric drivetrains is projected to rise 300%, according to Deloitte. China accounts for half of global EV unit sales, but EVs account for the highest percentage of auto sales in Norway (56%), Iceland (25%), and the Netherlands (15%). By 2040, about 70% of all vehicles sold in Europe – including passenger cars, trucks, vans, and buses – will be EVs, according to McKinsey.

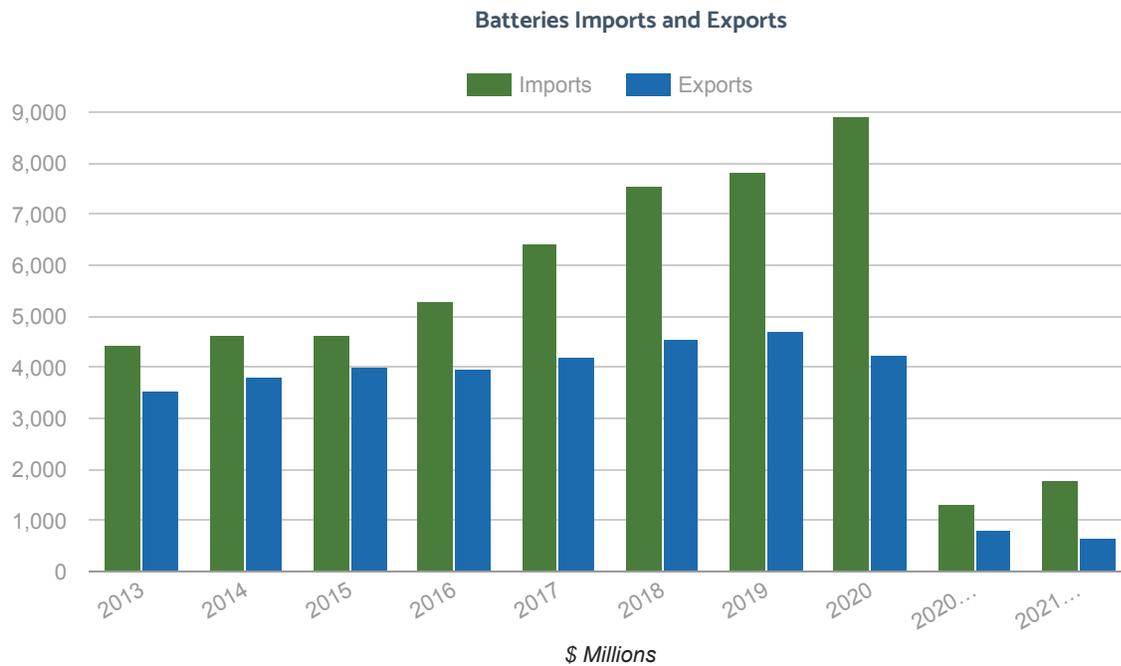
Asia Dominates – The EV battery market is dominated by China, Japan, and South Korea. In 2018, companies outside these three countries supplied less than 3% of global EV battery demand, according to McKinsey. As EVs gradually increase light vehicle market share, industry watchers note that North American and European automotive OEMs may become less competitive and face supply chain issues due to the relative lack of battery factories in their home regions. Asian firms not only dominate EV battery production, but also control much of the value chain, which in the case of some manufacturers includes mining operations for key inputs including lithium. Between 2000 and 2018, of the top 10 companies with international patent families for battery technology, nine are in Asia (primarily Japan and South Korea), according to a 2020 joint report by the European Patent Office and the International Energy Agency.

Electricity Grid Opportunities – Batteries are expected to become an integral component of future electricity grid infrastructure in both developed and developing markets. Applications include storing wind and solar energy, supporting smart grids, and making

existing grids more resilient and efficient regardless of energy source. Integrating battery storage capability into the grid has become national energy policy in countries including India, China, Japan, the UK, Germany, the US, and Australia. In 2017, more than two-thirds of Sub-Saharan Africa’s population lacked access to electricity, according to the UN. Off-grid solar energy is projected to help bridge Africa’s energy gap. The intermittent nature of solar energy will create strong demand for storage batteries to keep rural Africa’s electricity supply steady and reliable.

Next-Generation Technologies - The next advance in lithium-ion battery innovation is expected to be solid-state electrolytes. Current liquid gel electrolytes pose risk of inflammability. While solid-state electrolytes offer increased stability and a high level of specific energy, they remain expensive to produce. To solve the cost issue, patenting activity for solid-state electrolyte lithium-ion battery technology has risen an average of 25% per year since 2010, according to the European Patent Office and the International Energy Agency. Japan leads patenting activity, followed by the US.

International Trade

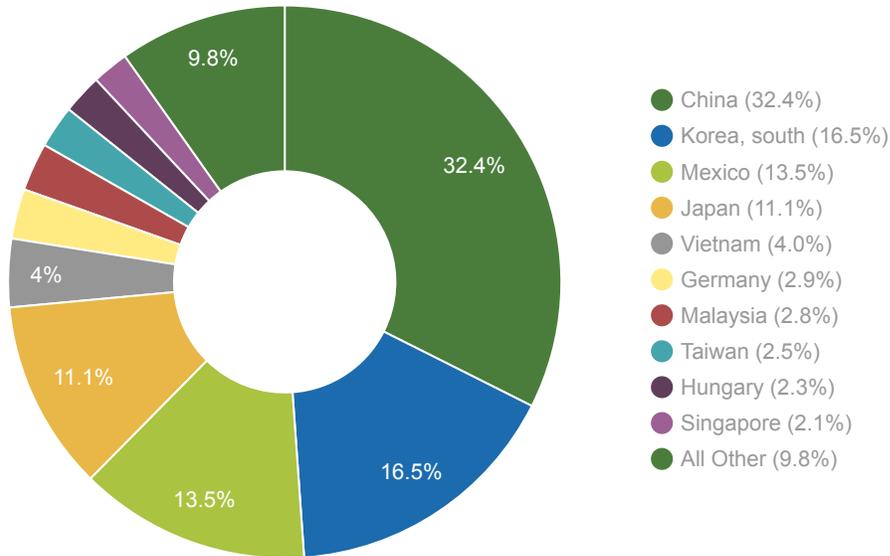


Batteries Year-to-Date Trade Data

| FEBRUARY 2021 | VALUE (\$MILLIONS) | % CHANGE |
|----------------------|--------------------|----------|
| Imports | \$1,784 | 26.4% |
| Exports | \$665 | -21.2% |
| Trade Balance | -\$1,119 | |

Imports by Country

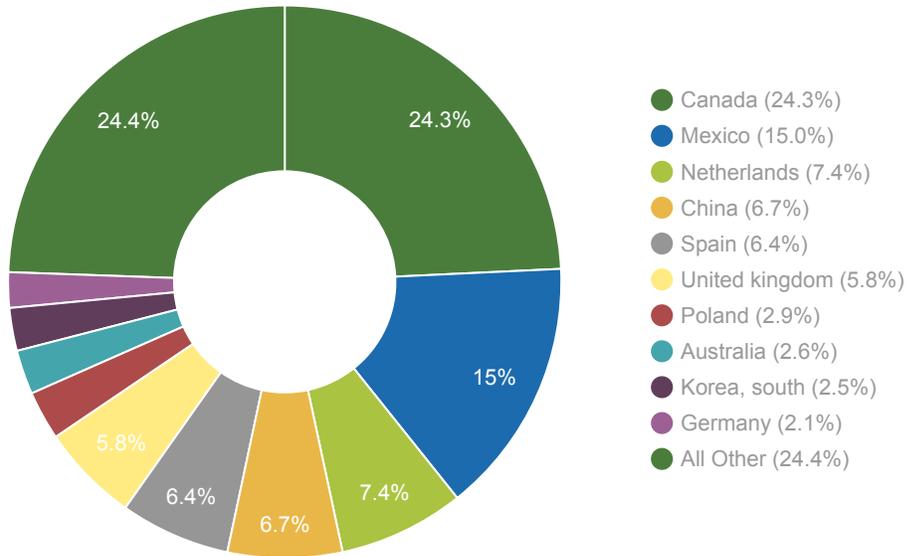
Batteries Imports



| COUNTRY | YEAR 2020 | % IMPORTS |
|--------------|-----------------|-----------|
| China | \$2,886,246,888 | 32.41% |
| Korea, south | \$1,466,536,962 | 16.47% |
| Mexico | \$1,202,652,851 | 13.51% |
| Japan | \$990,695,310 | 11.13% |
| Vietnam | \$355,526,982 | 3.99% |
| Germany | \$259,970,267 | 2.92% |
| Malaysia | \$250,620,001 | 2.81% |
| Taiwan | \$221,972,782 | 2.49% |
| Hungary | \$206,330,539 | 2.32% |
| Singapore | \$190,807,568 | 2.14% |
| All Other | - | 9.81% |

Exports by Country

Batteries Exports



| COUNTRY | YEAR 2020 | % EXPORTS |
|----------------|-----------------|-----------|
| Canada | \$1,031,906,024 | 24.25% |
| Mexico | \$639,295,660 | 15.03% |
| Netherlands | \$313,224,171 | 7.36% |
| China | \$284,556,420 | 6.69% |
| Spain | \$273,980,136 | 6.44% |
| United kingdom | \$244,493,954 | 5.75% |
| Poland | \$121,966,612 | 2.87% |
| Australia | \$110,203,533 | 2.59% |
| Korea, south | \$106,677,049 | 2.51% |
| Germany | \$88,219,102 | 2.07% |
| All Other | - | 24.44% |

Industry Trends

Trends are affected by the COVID-19 pandemic.

Changes in revenue, employment, business practices, trade and forecasts are occurring rapidly and data reporting by the government lags the changes. We are tracking changes in the “Coronavirus Update” chapter for those industries most affected and on our [Covid-19 Updates Webpage](#).

Producer Prices for Batteries Rise

Producer prices in the US battery industry rose for the fourth straight year, with pricing growth in the primary battery market offsetting declines in the storage market in 2020. The producer price index (PPI) for US battery manufacturing rose 3.7% in 2017, 5.7% in 2018, 1.3% in 2019 and 0.2% in 2020. The PPI for storage batteries increased 5.3% in 2017 and 6.6% in 2018 before declining 1% in 2019 and 0.3% in 2020. The PPI for primary batteries rose 0.4% in 2017, 4.6% in 2018, 5% in 2019 and 1.2% in 2020. In 2020, the PPI increase for primary batteries, which account for just 23% of industry revenue, compensated for the smaller PPI decrease for storage batteries, which account for 77% of industry revenue.

Lead Prices Drop

Commodity prices for lead, a key material for internal-combustion-engine (ICE) automotive starter batteries, have fallen due to slowing growth in global auto production. Lead prices fell 10.9% in 2019 and 3.2% in 2018, after rising 24.0% in 2017 and 4.4% in 2016, according to COMEX. Reductions in OEM battery production in the US and China, which account for over 40% of the world’s motor vehicles, have affected the global lead market according to Wood Mackenzie.

Battery Import Growth

The US battery import market continues to expand. Total imports of batteries climbed 13.7% in 2020, 3.5% in 2019, 17.9% in 2018, 21.5% in 2017, and 13.9% in 2016. China accounted for over 32% of the battery import market in 2020; the country has realized growth each year since 2011. Imports from Japan, which accounted for 11% of imports, rose 13.4% in 2020 and 6.4% in 2019. Imports from South Korea, which accounted for 16.5% of imports, increased 19% in 2020 after decreasing 15.2% in 2019.

Electric Vehicle Growth

The US electric vehicle (EV) market has experienced exceptional growth, although EVs share of the global market remains small. In the US, new registrations of EVs rose from 111,320 to 750,490 between 2013 and 2017, according to the 2018 IEA Global Electric Vehicle Outlook, a 575% increase. However, EVs only accounted for 0.8% of global vehicle sales in 2017. Experts predict that some models of EVs will achieve cost parity with internal-combustion-engine (ICE) vehicles by 2024 or 2025, and all EVs will do so by 2030, according to the US International Trade Commission (USITC). In the US, two Tesla models accounted for nearly half of all EV sales in 2017.

Lithium-Ion Battery Prices Fall

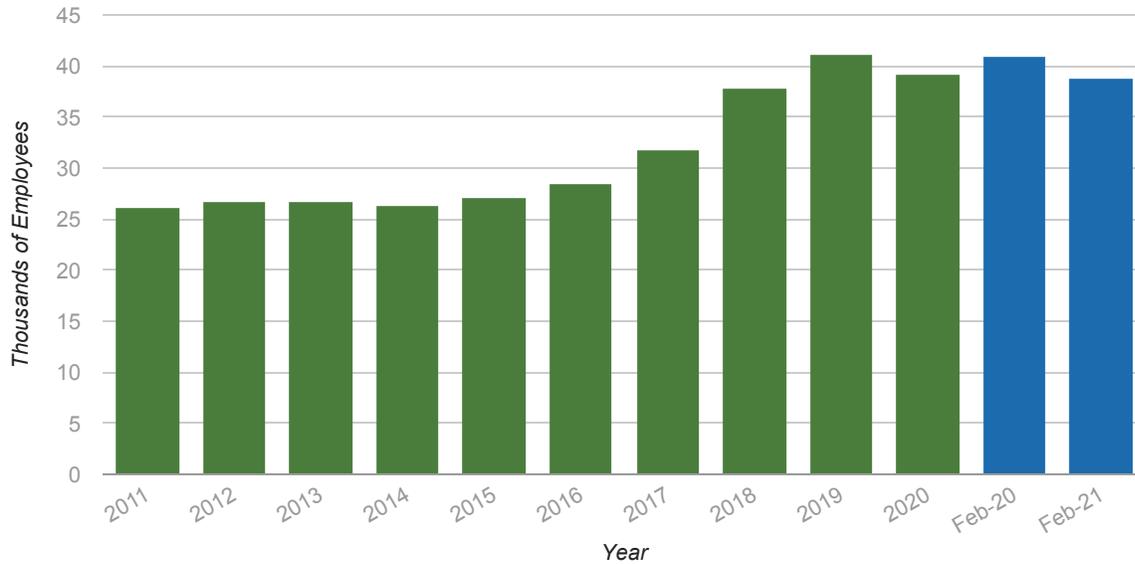
Prices for lithium-ion batteries, the main source of power in electric vehicles (EV), have dropped dramatically over time, driven by EV market growth. The lithium-ion battery volume-weighted average price fell 85% between 2010 and 2018, according to an annual survey by BloombergNEF, reaching \$176/kWh in 2018 from \$1,160/kWh in 2010. As the EV market emerges, automakers are investigating bringing battery expertise in-house, a move that diverges from traditional supply chain practices and could potentially affect the battery manufacturing industry.

Employment and Wage Trends

Employment by battery manufacturers decreases

Overall employment by battery manufacturers changed -5.1% in February compared to a year ago, according to the latest data from the Bureau of Labor Statistics.

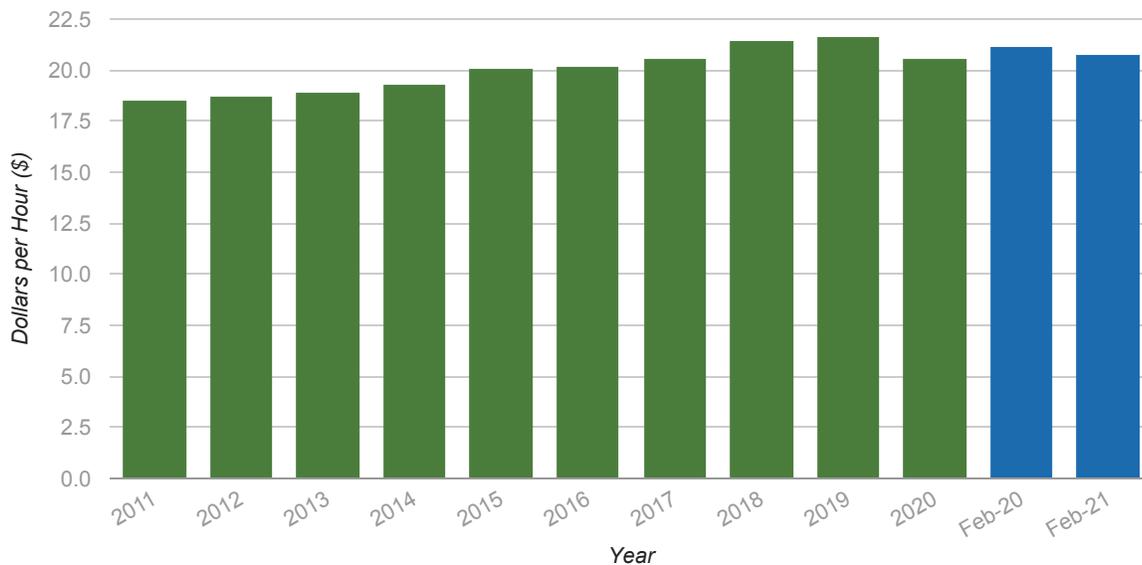
Battery Manufacturers Employment



Wages at other electrical equipment and components fall

Average wages for nonsupervisory employees at other electrical equipment and components were \$20.79 per hour in February, a -1.6% change compared to a year ago.

Average Wages for Nonsupervisory Employees

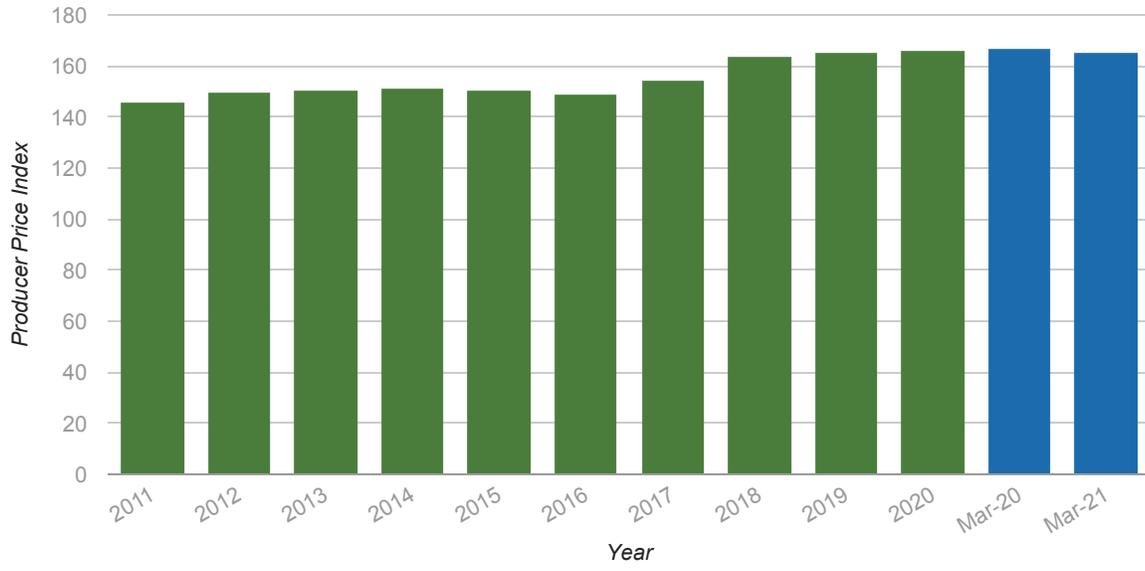


Price Trends

Producer Prices for battery manufacturers fall

The Producer Price Index for battery manufacturers changed -0.90% in March compared to a year ago, according to the latest data from the Bureau of Labor Statistics.

Producer Price Index for Battery Manufacturers



Credit Underwriting and Risks



| | | |
|------------------------------|-----|---|
| Business Exit Rates: | 4.0 | Lower than US average for all businesses |
| Cyclical Sensitivity: | 4.5 | Moderate Sensitivity |
| Barriers to Entry: | 2.8 | Very high initial capital; very high regulatory/technical barriers; very high concentration |
| External Risk: | 6.1 | High external risk |
| Industry Outlook: | 4.8 | Comparable to GDP; some cyclical risk |
| Financial Summary: | 5.0 | Low margins; high liquidity; low leverage |

Key Metrics

| METRIC | VALUE | COMPARISON |
|---|-------|----------------------|
| Performance During 2007–2009 Recession | 6.2% | 0.0% GDP |
| Business Exit Rate 2017–2018 | 7.08% | 9.0% All Industries |
| Compound Annual Growth Forecast (2019–2025) | 3.55% | 3.6% GDP |
| SBA 7(a) Default Rate by Number of Loans (2010–2019) | 0.00% | 3.82% All Industries |
| SBA 7(a) Default Rate by Gross Loan Amount (2010–2019) | 0.00% | 1.21% All Industries |

Underwriting Considerations

- How much of a risk is the supply chain for raw materials?
- With such large dominating players in this space, how is the company able to penetrate market share?
- Does the company have any contracts for the batteries they produce? How much of a percentage of revenues is contract based?
- Working Capital Lines of Credit are typical to support AR and Inventory, which are the typical collateral sources. Review a current AR Aging looking are concentration risk and AR over 90 Days. Look for stale inventory and WIP, which banks do not typically lend against.
- Look at AR and Inventory Day trends and compare to industry averages.
- This is a Cyclical industry and as such, it is recommended that the company have a sound balance sheet with lower leverage and higher liquidity to better manage through the economic turns.

Industry Risks

Keeping Up with Advances in Technology

Battery technology moves forward, even as manufacturers expand existing capacity to keep up with growing demand for lithium-ion products for electric vehicles (EV). Automakers and investors continuously investigate the next generations of battery technology, including solid state and lithium-silicon, according to BloombergNEF. Improvements to EV batteries include longer life spans, better fire resistance, and faster charges. Advances in technology create the risk of obsolescence for existing battery and battery manufacturing technology, and the timeline for transition is unknown.

Dependence on End Market Performance and the Economy

Demand for batteries is dependent on the performance of end markets, which can be sensitive to economic conditions. Automobile

and industrial vehicle manufacturers, some of the industry's largest customers, are especially vulnerable during downturns when reductions in consumer and commercial spending affect entire supply chains. A shift to private label brands, which also tends to occur during periods of financial uncertainty, can also depress battery sales.

Competition from Foreign Sources

US battery manufacturers face foreign competition, primarily from China, Japan, South Korea, and Mexico. China accounts for 32% of imports, while South Korea accounts for 16.5%, Mexico 13.5% and Japan 11%. China accounts for about two-thirds of global lithium cell production capacity, according to BloombergNEF, primarily due to generous electric vehicle (EV) subsidies. By subsidizing its domestic market for lithium-ion, China's battery manufacturing industry enjoys massive scale benefits. The US controls about 13% of global lithium-ion cell production capacity.

Variable Raw Material Cost and Supply

The cost and supply of raw materials can vary and affect profitability for battery manufacturers. The exceptional volatility of the price of lead can affect margins. Because supplies of lithium and cobalt are highly concentrated in a limited number of foreign countries (Democratic Republic of Congo, Australia, Chile, Argentina), markets for both metals are less transparent, and pricing is less predictable. China accounts for 85% of the world's capacity for processing rare earth ores into minerals and dominates lithium-ion battery cell and battery production.

Compliance with Government Regulation

The US battery manufacturing industry is regulated at the federal, state, and local levels. Manufacturing in foreign countries can involve additional regulation. Compliance with extensive and evolving environmental, health, and safety laws is especially important because the production process can involve large amounts of hazardous materials, most notably lead and acid. Regulations govern the generation, handling, storage, use, transportation, and disposal of hazardous materials and can generate incremental operating costs. Firms that contaminate soil and groundwater are responsible for remediating damage.

Company Risks

Price-Based Competition

Price has become an increasingly important basis for competition in the battery industry due to excess capacity in certain sectors of the market, consolidation among industrial battery purchasers, and concentration in the retail end of the supply chain. Low-cost lithium-ion imports from China depress prices in several sectors of the industry. In the US primary battery market, a small number of large companies fight for limited retail and virtual shelf space from customers that frequently demand discounts and more favorable trade programs. Private label brands steal share by offering lower prices.

Competition with Large Players

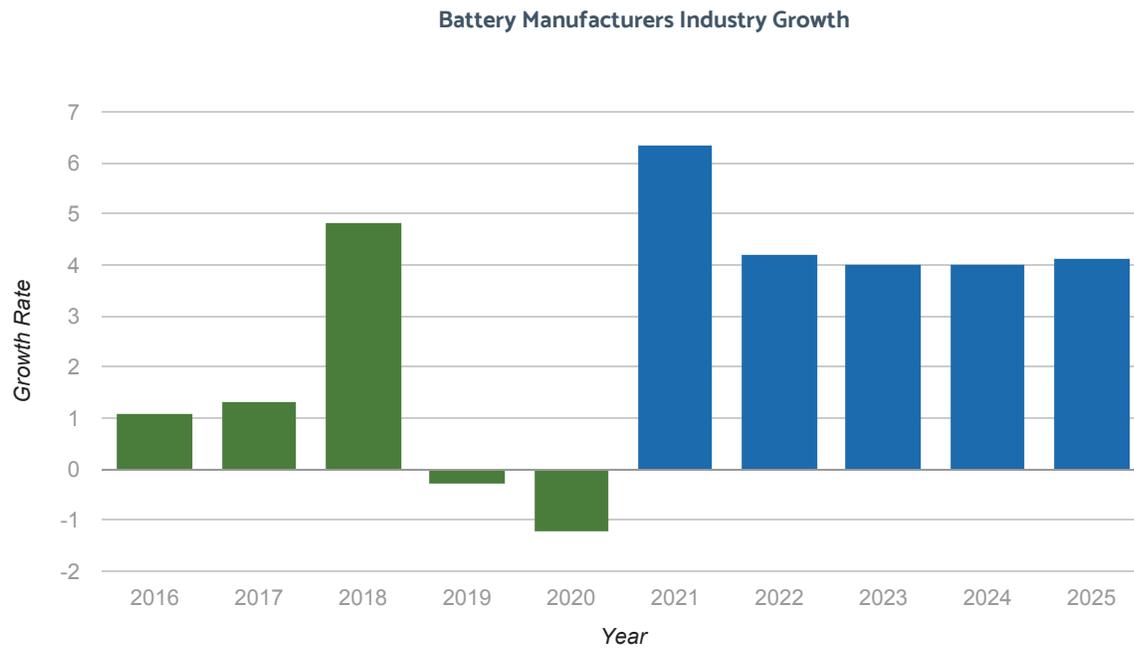
The US battery manufacturing industry is dominated by large firms with domestic and international operations. In both the storage and primary battery markets, the top 50 firms account for about 99% of industry sales, and the top four firms account for 70% and 87%, respectively. Scale is critical to achieving low production costs and gives large firms a competitive advantage. Some major industrial battery manufacturers are vertically integrated, which reduces exposure to fluctuating raw material costs.

Industry Forecast

Sales for the US industry are forecast to grow at a 3.55% compounded annual rate from 2019 to 2025, slower than the growth of the overall economy.

Vertical IQ forecasts are based on the Inforum inter-industry economic model of the US economy. Inforum forecasts were prepared by the Interindustry Economic Research Fund, Inc.

Last Update: January 2021



Working Capital

Sell and invoice

Battery manufacturers generate revenue by selling primary and secondary (storage) batteries to retailers, wholesalers, other manufacturers, and utilities. Firms may have contracts with retail customers and sell units based on a list price. Promotional programs involve discounts based on a fixed percentage price reduction or reimbursement based on sales performance. Contracts with commercial customers may include pricing adjustments to compensate for fluctuations in the cost of raw materials, such as lead.

Collect

Most companies offer customer credit. Collection periods average 50 to 64 days and receivables average 24-31% of assets.

Manage Cash

Cash flow is primarily driven by volume. Large customers serve as sources of recurring sales. Major customer segments, including general retail and automotive manufacturing, are concentrated and dominated by large players, and the loss of a big account can have a severe effect on cash flow. Conversely, securing a new account can generate a sizeable increase in sales.

New products and improvements to existing product lines are essential to generating growth and incremental business. Firms continually invest in research and development to discover and integrate new technologies and respond to advances by competitors. The timeline to commercialize new battery technology is long, and firms may have to wait decades before realizing a return on investment. Variations on current lithium-ion technology required about 10 years of research, according to CNBC.

Gross margins average about 27-30% of sales, and in some cases, raw materials can account for over half the cost of goods sold. The cost of raw materials (particularly lead) can fluctuate according to global market conditions and have a substantial effect on profitability. Scale and production efficiency allow firms to maintain low manufacturing costs and preserve cash flow. Speeding up production, improving yield, and minimizing machine downtime can improve margins. Certain phases of the cell finishing process involve multiple charging and discharging cycles, which can take between two and ten hours, according to BCG. During the aging process, finished battery cells are stored for several weeks in order to identify micro short circuits.

Pay

Labor costs are relatively low and average about 10% of sales. Because the cost of certain metals can fluctuate dramatically (even daily for lead), large firms enter into hedging arrangements to reduce variability and protect margins. Other metals commonly used in batteries include manganese, zinc, silver, nickel, lithium, graphite, and steel. Auto manufacturers typically contract with Asian suppliers for the cells that comprise lithium-ion battery modules and packs.

Rent averages about 1% of sales and advertising averages less than 1% of sales.

Report

After-tax net profit averages about 3% of sales. Production capacity for lithium-ion battery manufacturing generally is measured in gigawatt-hours (gWh), while cost is stated per kilowatt-hour (kWh). For example, BloombergNEF estimated that the volume-weighted average for lithium-ion batteries was \$176/kWh in 2018 and projected to fall to \$94/kWh in 2024 and \$62/kWh in 2030. Capacity utilization is important because battery manufacturing is a volume-driven industry that is dependent on scale advantages. Overcapacity has periodically been a problem in the industry, according to BCG.

Cash Management Challenges

Volatility in Raw Material Costs

The price of raw materials used by battery manufacturers can be volatile, particularly metals like lead, lithium, zinc, and silver. Fluctuations in prices due to global supply and demand can affect gross margins for battery manufacturers and disruptions in supplies can make it difficult to maintain production capacity utilization.

Cash Shortfalls During Periods of Slow Demand

Demand for batteries can be somewhat seasonal and cyclical, driven by automobile sales and consumer spending on toys, personal electronics, and other household items. With high fixed production costs, periods of slow demand can result in temporary cash shortfalls in meeting operational expenses.

Timely Collections from Large Manufacturers and Retailers

Battery manufacturers can be highly dependent on large auto manufacturers and large general retail chains for sales. This dependence gives these customers negotiating clout in setting contract terms and they may be slow to pay. As a result, collection periods for battery manufacturers can be lengthy.

Capital Financing

Projects that require capital financing include the purchase of property, buildings, machinery, equipment, and technology and information systems. The battery manufacturing process is highly automated, and companies have significant investments in manufacturing facilities. For electric vehicle batteries, assembly machines have limited flexibility, so new product introductions can require significant capital investment in new machinery or, in some cases, a new factory, according to BCG. Because battery manufacturing is a global business, large firms typically have plants and distribution networks throughout the world. Firms may opt to lease equipment and facilities instead of building to minimize upfront capital investment.

Battery manufacturers also require capital to fund growth initiatives, by opening new plants, expanding existing facilities, acquiring other companies, or investing in new technology. Acquisitions allow firms to enter new geographical or product markets and access new technology. Large firms have been active in the acquisitions market over the last few years.

Sources of financing for publicly held firms include cash, stock, debt, or a combination. Lithium-ion and new battery technologies have become attractive investment vehicles. Start-ups that are developing the next generation of batteries have raised millions through venture capitalists, corporate investors (global battery and auto manufacturers), and private investors. Battery storage companies raised a record \$1.4 billion in venture funding during the first half of 2019, according to Mercom Capital Group.

Examples of Equipment Purchases



Lithium Cylinder Cell Winding Machine

\$50,000 – 100,000

Semi-automatic winding of anode, cathode, and separator materials to form cylinder cell battery.



Lithium Ion Pouch Cell Battery Assembler

\$100,000 – 200,000

Assembles pouch cell and prismatic batteries.



Lead Acid Car Battery Plate Surface Drying Machine

\$25,000 – 45,000

Dries and cures positive and negative plates before assembly in lead acid batteries.



Battery Case Punch

\$5,000 – 15,000

Creates holes in the case for lead acid car batteries.



Short Circuit Battery Tester

\$3,500 – 10,000

Tests pouch cell or its battery pack under variable pressure and temperature to identify any short circuit or safety issues.

Business Valuation

Financial Benchmarks

The following financial benchmark data is based on annual financial statements submitted by member institutions of the Risk Management Association from Q2 of the first year listed through Q1 of the following year.

Financial Ratios (Battery Manufacturers, Industry-wide)

| MEASURE | 2017-18 | 2018-19 | 2019-20 |
|---|---------|---------|---------|
| Current Ratio [?] | 2.33 | 1.9 | 1.77 |
| Quick Ratio [?] | 0.88 | 0.81 | 0.83 |
| Days Inventory [?] | 96.0 | 74.0 | 76.0 |
| Days Receivables [?] | 50 | 51 | 54 |
| Days Payables [?] | 43.0 | 32.0 | 48.0 |
| Pre-tax Return on Revenue [?] | 2.93% | 2.35% | 2.36% |
| Pre-tax Return on Assets [?] | 4.43% | 4.04% | 4.2% |
| Pre-tax Return on Net Worth [?] | 8.03% | 8.14% | 8.47% |
| Interest Coverage [?] | 6.66 | 5.22 | 6.5 |
| Current Liabilities to Net Worth [?] | 0.55 | 0.72 | 0.77 |
| Long Term Liabilities to Net Worth [?] | 0.26 | 0.3 | 0.25 |
| Total Liabilities to Net Worth [?] | 0.81 | 1.02 | 1.02 |
| <i>Number of Firms Analyzed</i> | 24 | 19 | 21 |

Income Statement (Battery Manufacturers, Industry-wide)

| ITEM | 2017-18 | 2018-19 | 2019-20 |
|---------------------------------|---------|---------|---------|
| Revenue | 100.0% | 100.0% | 100.0% |
| Cost of Sales | 71.63% | 73.1% | 69.67% |
| Gross Margin | 28.37% | 26.9% | 30.33% |
| Officers Compensation | 1.92% | 0.6% | 0.74% |
| Salaries-Wages | 9.0% | 9.41% | 9.43% |
| Rent | 1.05% | 1.08% | 1.08% |
| Taxes Paid | 1.38% | 1.4% | 1.37% |
| Advertising | 0.57% | 0.5% | 0.43% |
| Benefits-Pensions | 2.24% | 2.42% | 2.52% |
| <i>Number of Firms Analyzed</i> | 24 | 19 | 21 |

| ITEM | 2017-18 | 2018-19 | 2019-20 |
|---------------------------------|---------|---------|---------|
| Repairs | 0.33% | 0.32% | 0.3% |
| Bad Debt | 0.22% | 0.27% | 0.33% |
| Other SG&A Expenses | 6.58% | 8.19% | 7.0% |
| EBITDA | 5.08% | 2.71% | 7.13% |
| Amortization-Depreciation | 1.3% | 1.2% | 1.98% |
| Operating Expenses | 24.59% | 25.39% | 25.18% |
| Operating Income | 3.78% | 1.51% | 5.15% |
| Interest Expense | 0.85% | 0.96% | 1.46% |
| Other Income | -0.3% | -0.12% | 0.3% |
| Pre-tax Net Profit | 3.23% | 0.67% | 3.39% |
| Income Tax | 0.4% | 1.07% | 0.48% |
| After Tax Net Profit | 2.83% | -0.4% | 2.91% |
| <i>Number of Firms Analyzed</i> | 24 | 19 | 21 |

Balance Sheet (Battery Manufacturers, Industry-wide)

| ASSETS | 2017-18 | 2018-19 | 2019-20 |
|---------------------------------|---------|---------|---------|
| Cash | 13.46% | 9.24% | 7.91% |
| Receivables | 24.93% | 30.79% | 24.19% |
| Inventory | 33.23% | 27.53% | 30.61% |
| Other Current Assets | 5.76% | 5.32% | 3.82% |
| Total Current Assets | 77.38% | 72.89% | 66.53% |
| Net Fixed Assets | 12.71% | 13.15% | 13.1% |
| Net Intangible Assets | 7.2% | 10.91% | 17.48% |
| Other Non-Current Assets | 2.71% | 3.05% | 2.9% |
| <i>Total Assets</i> | 100.0% | 100.0% | 100.0% |
| LIABILITIES | | | |
| Accounts Payable | 17.91% | 20.47% | 15.92% |
| Loans/Notes Payable | 13.19% | 9.94% | 11.61% |
| Other Current Liabilities | 9.12% | 21.3% | 5.06% |
| <i>Number of Firms Analyzed</i> | 24 | 19 | 21 |

LIABILITIES

| | | | |
|---------------------------------|--------|--------|--------|
| Total Current Liabilities | 40.22% | 51.71% | 32.58% |
| Total Long Term Liabilities | 16.87% | 12.27% | 17.62% |
| Total Liabilities | 57.08% | 63.98% | 50.2% |
| Net Worth | 42.92% | 36.01% | 49.8% |
| Total Liabilities & Net Worth | 100.0% | 100.0% | 100.0% |
| <i>Number of Firms Analyzed</i> | 24 | 19 | 21 |

Vertical IQ financial benchmark data is based on data provided by the Risk Management Association (RMA) and Powerlytics, Inc. RMA's Annual Statement Studies provide comparative industry financial benchmarks based on financial statements of small and medium business clients of RMA's member institutions. Additional detail on income statement line items is provided using Powerlytics financial benchmarks, which are based on reporting submitted to the IRS. Additional detail on these data sources can be found at [RMA](#) and [Powerlytics](#).

Quarterly Insight

1st Quarter 2021

Biden Proposes Electrifying Federal Vehicle Fleet

President Biden announced a plan to replace the federal government's vehicle fleet with electric vehicles assembled in the US. The federal government had 645,000 vehicles as of 2019, according to the General Services Administration. About 35% of those vehicles were operated by the US Postal Service. Kurt Breitenkamp, vice president of business development at battery development company NanoGraf, said that the demand created by the federal government will create upstream demand for batteries and the materials used to construct them. That, in turn, will create a much more dynamic American battery market. Biden did not specify a time frame for switching the government's "enormous fleet" to EVs.

4th Quarter 2020

Recyclability Counts During Design Phase

A variety of industry stakeholders have begun focusing on battery design in hopes of increasing recycling rates. Only about 5% of lithium-ion batteries are recycled in the US, according to experts. Some types of batteries, like lead-acid batteries, have relatively simple chemistries and designs that make them straightforward to recycle, but lithium-ion batteries pose more complex recycling and disposal challenges because they contain many chemical components that are both toxic and difficult to separate. It currently costs more to recycle a lithium-ion battery than the recoverable materials inside it are worth. Proposed changes include accelerating development of solid state batteries, which are safer to recycle; better labeling to facilitate automated sorting of large volumes of batteries at waste facilities; and international standardization of recycling policies to help manufacturers design batteries that can be used and recycled anywhere.

3rd Quarter 2020

Tesla Offers to Supply Batteries to Other Automakers

Automaker Tesla's CEO Elon Musk said that the company is open to licensing software and supplying powertrains and batteries to other automakers. Tesla currently runs a battery joint venture with Panasonic Corp., and is planning to build its own battery manufacturing facility at its Fremont, CA, plant under its "roadrunner" project. Musk has also said that Tesla would allow others to use its patents in hopes of speeding up development of electric cars by all manufacturers.

1st Quarter 2020

Chinese Battery Manufacturers Ramp Up After Virus Shutdown

Most major lead-acid battery makers in China have resumed production following the coronavirus, or Covid-19, outbreak, according to the Shanghai Metals Market. Major producers have reached 60-70% of capacity and the ramp-up in production is expected to continue through early March. Chinese battery maker Leach said that it would be able to make up the shortfall in production caused by the break in operations due to the virus within a month and expects no lasting impact on its business.

Call Prep Questions

Working Capital

What does your company consider when establishing contracts with customers?

Firms may have contracts with retail customers and sell units based on a list price. Contracts with commercial customers may include pricing adjustments to compensate for fluctuations in the cost of raw materials, such as lead.

How dependent is your company on large accounts?

Large customers serve as sources of recurring sales. Major customer segments, including general retail and automotive manufacturing, are concentrated and dominated by large players, and the loss of a big account can have a severe effect on cash flow.

How does your company minimize variability in raw material costs?

The cost of raw materials (particularly lead) can fluctuate according to global market conditions and have a substantial effect on profitability. Because the cost of certain metals can fluctuate dramatically (even daily for lead), large firms enter into hedging arrangements to reduce variability and protect margins.

What types of agreements does your company have with suppliers?

Auto manufacturers typically contract with Asian suppliers for the cells that comprise lithium-ion battery modules and packs.

What is your company's manufacturing capacity?

Production capacity for lithium-ion battery manufacturing generally is measured in gigawatt-hours (gWh), while cost is stated per kilowatt-hour (kWh).

What is your company's capacity utilization?

Capacity utilization is important because battery manufacturing is a volume-driven industry that is dependent on scale advantages. Overcapacity has periodically been a problem in the industry, according to BCG.

Capital Financing

What types of projects typically require capital financing?

Projects that require capital financing include the purchase of property, buildings, machinery, equipment, and technology and information systems.

What does your company consider when investing in new manufacturing equipment?

The battery manufacturing process is highly automated, and companies have significant investments in manufacturing facilities. For electric vehicle batteries, assembly machines have limited flexibility, so new product introductions can require significant capital investment in new machinery or, in some cases, a new factory, according to BCG.

How does your company handle foreign operations?

Because battery manufacturing is a global business, large firms typically have plants and distribution networks throughout the world.

What role does capital play in your company's growth plans?

Battery manufacturers also require capital to fund growth initiatives, by opening new plants, expanding existing facilities, acquiring other companies, or investing in new technology.

What does your company look for in potential acquisitions?

Acquisitions allow firms to enter new geographical or product markets and access new technology. Large firms have been active in the acquisitions market over the last few years.

What are your company's main sources of capital financing?

Sources of financing for publicly held firms include cash, stock, debt, or a combination. Lithium-ion and new battery technologies have become attractive investment vehicles. Start-ups that are developing the next generation of batteries have raised millions through venture capitalists, corporate investors (global battery and auto manufacturers), and private investors.

How Firms Operate

What are your company's main end-use markets?

Battery manufacturers produce power sources for household, commercial, and industrial use.

What types of products does your company produce?

Major types of products include storage batteries, primary batteries, and parts for storage batteries.

What are your company's primary battery technologies?

Lithium-ion batteries are among the most popular rechargeable batteries, particularly for electrical vehicles (EV) and personal electronic devices. Nickel-cadmium batteries are heavier than lithium-ion batteries but provide similar performance. Lead-acid batteries include starting batteries, like a car. Fuel cells convert chemical energy to electrical energy and are used to power satellites, space capsules, cars, boats, and submarines.

Who are the main players in your company's supply chain?

Cell production, assembly, and packing processes may occur in different locations with different manufacturers.

What are your company's primary sources of supply?

Primary raw materials include lead, lithium, manganese, zinc, silver, nickel, steel, graphite, copper, cobalt, electrolytes, and plastics.

What kind of commitment does your company have to research and development?

Employees in research and development have scientific and technical expertise. Firms typically employ some unionized labor.

Industry Risks

How does your company stay current with the newest battery technology?

Battery technology moves forward, even as manufacturers expand existing capacity to keep up with growing demand for lithium-ion products for electric vehicles (EV).

How diversified are your company's end-use markets?

Demand for batteries is dependent on the performance of end markets, which can be sensitive to economic conditions.

How is your company addressing foreign competition?

US battery manufacturers face foreign competition, primarily from China, Japan, South Korea, and Mexico.

How does your company compensate for variability in raw material cost and supply?

The cost and supply of raw materials can vary and affect profitability for battery manufacturers.

How does your company ensure regulatory compliance?

The US battery manufacturing industry is regulated at the federal, state, and local levels.

Industry Trends

How has your company's pricing strategy changed over the last few years?

Producer prices in the US battery industry rose for the fourth straight year, with pricing growth in the primary battery market offsetting declines in the storage market in 2020.

How is your company managing raw material costs?

Commodity prices for lead, a key material for internal-combustion-engine (ICE) automotive starter batteries, have fallen due to slowing growth in global auto production.

How does your company compete against imported products?

The US battery import market continues to expand.

How is your company leveraging growth in the electric vehicle (EV) market?

The US electric vehicle (EV) market has experienced exceptional growth, although EVs share of the global market remains small.

How is your company addressing pricing pressure?

Prices for lithium-ion batteries, the main source of power in electric vehicles (EV), have dropped dramatically over time, driven by EV market growth.

Industry Terms

Battery (or energy – ESS) Storage System

Uses battery technology to store energy from a source, such as solar panels or a power plant, for use at a later time.

Battery Module

Assembly of multiple battery cells

Battery Pack

Assembly of multiple battery modules

BCI

Battery Council International, classification that defines groups of batteries by the physical dimensions of the battery case

Cell

Most basic component of a battery – a cathode and an anode separated by an electrolyte used to produce a voltage or current when the ends are connected

Deep Cycle Battery

Battery that delivers a low, steady level of power and is used to power accessories

Dry Cell Battery

Batteries that rely on a mostly solid substance for power

Dual-Purpose Battery

Battery that offers a combination of starting and deep cycle power

Fuel Cell

Battery that converts chemical energy to electrical energy and are used to power satellites, space capsules, cars, boats, and submarines

Industrial Battery

Battery that can provide low steady power over an extended period of time

Lithium-Ion Batteries

One of the most popular rechargeable batteries, particularly for electrical vehicles and personal electronic devices

Motive Battery

Battery used for industrial equipment and machinery, such as a forklift, which requires electrical power for the vehicle and its accessory

Primary Battery

Batteries that are single-use products and cannot be recharged

Secondary/Storage Battery

Batteries that are rechargeable and found in consumer electronic devices (such as smartphones and tablets), vehicles and back-up power sources

Standby Battery

Battery that provides power to critical systems in the event of a power outage

Wet Cell Battery

Battery that draws power from a liquid electrolyte

Web Links

[Battery Council International](#)

News, trends and basic information on the battery industry

[US Energy Information Administration \(EIA\)](#)

News, trends, statistics, and studies on electrical power industry

[BloombergNEF](#)

News, trends, and statistics on the energy market, electrical vehicles, and battery technology

[US Energy Department](#)

News, trends, statistics, and studies on energy in the US

[National Renewable Energy Laboratory \(NREL\)](#)

News, trends, and studies on renewable energy, including lithium-ion technology

Related Profiles

Automobile Manufacturers

NAICS: 336111, 336112 SIC: 3711

Electric Power Generation & Distribution

NAICS: 2211 SIC: 4911, 4931, 4939

Electronic Component Manufacturers

NAICS: 334416, 334417, 334419 SIC: 3671, 3675, 3676, 3677, 3678, 3679

Solar Electric Power

NAICS: 221114 SIC: 4911

Wind Power

NAICS: 221115 SIC: 4911

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