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Batteries included: Fuel-efficiency trends will increase demand from automakers

IBISWorld Industry Report 33591

Battery Manufacturing in the US

March 2019

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About this Industry

Industry Definition

This industry manufactures storage and primary batteries. Storage batteries are also known as secondary or rechargeable batteries; primary batteries are nonrechargeable. Industry products have a variety of uses in cell phones, medical equipment, households and the automotive and transport sectors.

Main Activities

The primary activities of this industry are

- Alkaline battery manufacturing
- Automobile battery manufacturing
- Lead-acid storage battery manufacturing
- Nickel-cadmium storage battery manufacturing
- Alkaline manganese primary battery manufacturing
- Flashlight battery manufacturing
- Lithium battery manufacturing
- Transistor radio battery manufacturing
- Watch battery manufacturing
- Zinc-carbon battery manufacturing

The major products and services in this industry are

- Battery parts
- Primary batteries
- Secondary batteries
- Other

Similar Industries

33422 Communication Equipment Manufacturing in the US
This industry primarily manufactures broadcasting and other wireless communications equipment.

33431 Audio & Video Equipment Manufacturing in the US
This industry primarily manufactures electronic audio and video equipment for home entertainment systems, vehicles and public areas.

33511 Lighting & Bulb Manufacturing in the US
This industry manufactures a range of electric light bulbs, tubes, parts and components.

33531 Electrical Equipment Manufacturing in the US
This industry primarily manufactures power, distribution and electric motors, generators and relays.

33599 Power Conversion Equipment Manufacturing in the US
This industry manufactures carbon and graphite products, laser systems and electrical-power conversion equipment.

About this Industry

Additional Resources

For additional information on this industry

www.batterycouncil.org
Battery Council International

www.cta.tech
Consumer Technology Association

www.eia.gov
US Energy Information Administration

Industry at a Glance

Battery Manufacturing in 2019

Key Statistics Snapshot

Revenue	Annual Growth 14–19	Annual Growth 19–24
$13.3bn	1.0%	1.2%
Profit	**Exports**	**Businesses**
$503.8m	$3.9bn	190

Market Share

Johnson Controls International PLC 30.5%

Energizer Holdings Inc. 11.0%

EnerSys Inc. 9.1%

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Key External Drivers

- Housing starts
- Research and development expenditure
- Consumer spending
- Trade-weighted index

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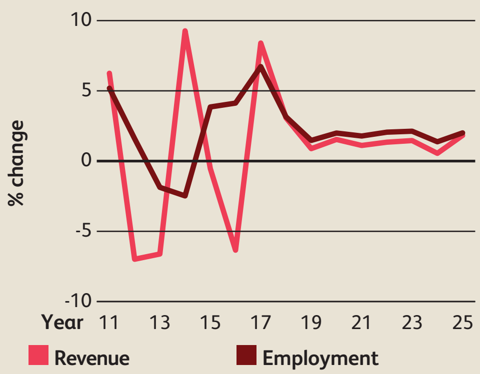
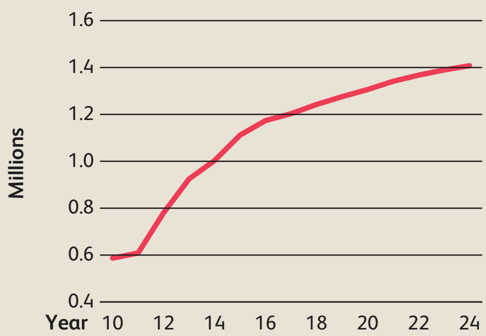
Revenue vs. employment growth

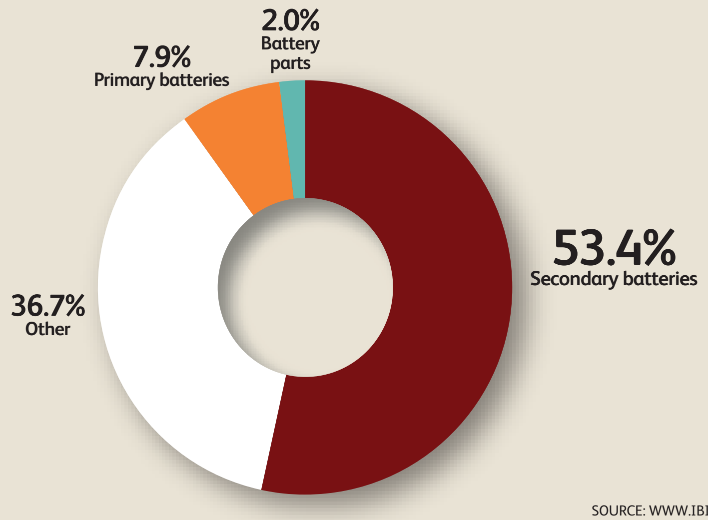


Housing starts



SOURCE: WWW.IBISWORLD.COM

Products and services segmentation (2019)



SOURCE: WWW.IBISWORLD.COM

Industry Structure

Life Cycle Stage	Mature	Regulation Level	Heavy
Revenue Volatility	Medium	Technology Change	High
Capital Intensity	Low	Barriers to Entry	High
Industry Assistance	Medium	Industry Globalization	High
Concentration Level	Low	Competition Level	Medium

FOR ADDITIONAL STATISTICS AND TIME SERIES SEE THE APPENDIX ON PAGE 36

Industry Performance

Executive Summary | Key External Drivers | Current Performance
Industry Outlook | Life Cycle Stage

Executive Summary

The Battery Manufacturing industry is expected to expand over the five years to 2019. The industry's growth is largely attributable to the increasing popularity of electric and hybrid vehicles among consumers brought about by companies such as Tesla Inc. As demand for electric vehicles has grown, demand for lithium-ion battery packs has grown in tandem. In response, the industry has accepted several new entrants specializing in electric vehicle (EV) battery pack manufacturing. Separate from demand for EV batteries, demand for primary batteries (i.e. AA batteries) has also increased due to greater levels of consumer spending on electronics and growing new car sales. Overall, IBISWorld expects industry revenue to increase at an annualized rate of 1.0% to $13.3 billion over the five years to 2019, including forecast growth of 0.9% in 2019 alone.

Demand for secondary batteries in cars and electronic devices has grown over the past five years

Although the industry has experienced heighted demand for both primary and secondary batteries, the industry's growth has been hindered by its significant trade deficit. Given lower regulatory and wage costs, a substantial portion of the world's batteries are manufactured in China and South Korea. In fact, China and South Korea represent the largest and second-largest importers of batteries into the United States, respectively. Moreover, an unfavorable trade-weighted index, which measures the value of the US dollar against other major currencies, has adversely affected the industry's trade deficit, ultimately driving imports up an annualized 12.1% over the five years to 2019, far outpacing growth in exports. As imports continue to satisfy a greater share of domestic demand, the industry will become increasingly competitive. As a result, industry profit margins are expected to decline over the five years to 2019.

However, this trend is expected to shift over the five years to 2024 as domestic production continues to expand and the trade-weighted index begins to reflect a weakening US dollar. In particular, the Federal Reserve's latest move to hold off on interest rate hikes is expected to depress the value of the US dollar, ultimately making exports more competitive in international markets while having the opposite effect on imports in domestic markets. In addition, demand for EVs is forecast to continue growing as automakers continue to expand their EV and hybrid vehicle offerings. As a result, IBISWorld expects industry revenue to increase an annualized 1.2% to $14.1 billion over the five years to 2024.

Key External Drivers

Housing starts

Housing starts represent growth in the construction of new houses. When consumers purchase houses, they typically require a variety of electrical products that rely on batteries. Consequently, growth in housing starts leads to increased demand for batteries, positively affecting demand for industry products. The number of housing starts is expected to increase in 2019.

Research and development expenditure

Manufacturers continuously develop new technologies to better maintain their market position. Demand increases with the development of new products. For example, new lightweight batteries that have longer lifespans and offer superior performance are often favored over older technology. Research and development expenditure is expected to exhibit slowed

Industry Performance

Key External Drivers continued

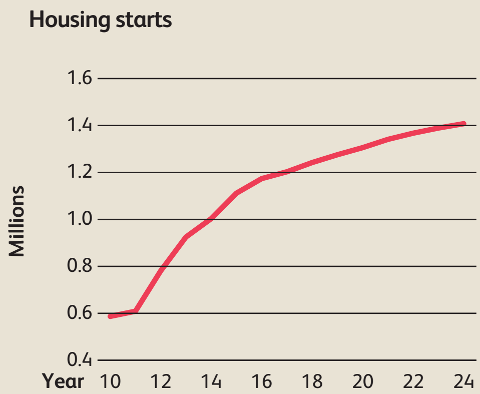
growth in 2019, presenting a potential threat to the industry.

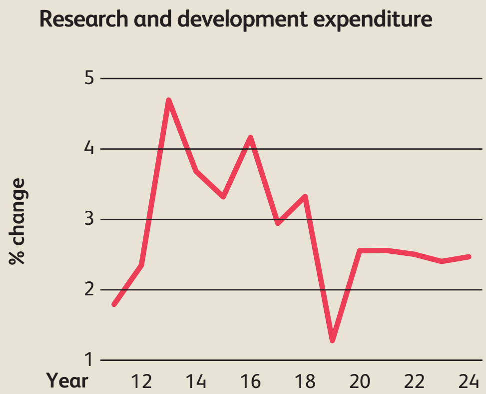
Consumer spending

Batteries have become an indispensable household item because they are used for a range of portable electronics, from wireless electric razors to flashlights. High disposable income contributes to favorable spending patterns and increases demand for batteries. Consumer spending is expected to increase in 2019, representing a potential opportunity for the industry.

Trade-weighted index

When the trade-weighted index (TWI) rises, domestically manufactured batteries become more expensive abroad and thus foreign demand decreases. Conversely, foreign-manufactured batteries become less expensive and domestic demand for imports increases. The TWI is expected to decline in 2019.





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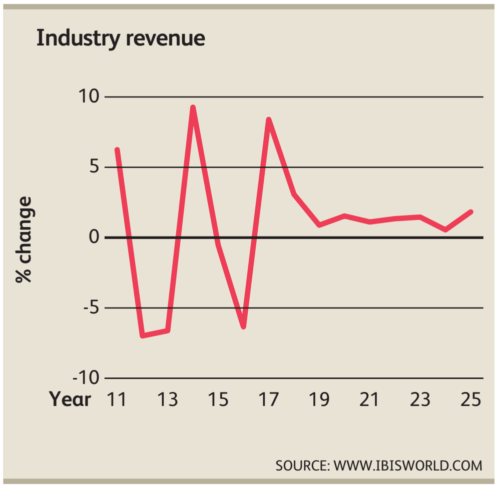
Industry Performance

Current Performance

The Battery Manufacturing industry produces various types of batteries ranging from single-cell alkaline batteries used in flashlights to multicell lithium-ion battery packs custom-built for electric vehicle propulsion. Given the proliferation of batteries across numerous end uses, the industry is dependent on the overall health of the economy. In particular, demand for electric and hybrid vehicles as well as consumer electronics represent the key drivers of demand for industry products. However, increased demand for electric vehicles has been the leading driver of increased investment in US battery production over the past decade. More recently, demand for electric vehicles has continued its ascent, and, in response, certain battery manufacturers have expanded their operations to meet growing demand. Nevertheless, as demand for lithium-ion batteries has risen, imports have increased at a substantial rate given a strong US dollar and untimely tariff announcements. Rising import penetration is expected to hamper the industry's growth during the five-year period. Overall, these trends are expected to result in a net benefit to the industry, ultimately driving revenue growth during the five-year period. Over the five years to 2019, IBISWorld forecasts industry revenue to increase at an annualized rate of 1.0% to $13.3 billion, including expected growth of 0.9% in 2019 alone.



Automotive industry and batteries

Car and automobile manufacturers primarily use lead-acid batteries and lithium-ion batteries in the production of vehicles. Fuel prices have a highly complex relationship in determining demand for automobiles. When fuel prices are high, consumers are more willing to switch to hybrid or fully electric vehicles, which use more-expensive, higher-margin industry batteries, to avoid paying high gasoline prices. Conversely, declining fuel prices can lead to a decrease in demand for alternative-energy vehicles. Moreover, declining fuel prices encourage consumers to purchase traditional gasoline-powered vehicles. Over the five years to 2019, the world price of crude oil is expected to decline an annualized 6.9%, encouraging consumers to continue using their traditional gasoline-powered vehicles.

Despite this, battery manufacturers have continued to heavily invest in the development of more-efficient, longer-lasting batteries to boost profit and differentiate their products from low-cost imports. Battery manufacturers often benefit from assistance provided by the US Department of Energy and the US Advanced Battery Consortium. Much of the research over the past five years has focused on improving lithium-ion batteries, which are often used in electronic devices and stop-start battery technology for automobiles. The creation of more-efficient batteries enables companies to charge a premium for these products and generate additional revenue.

Industry Performance

Global drivers

The appreciation of the US dollar during the period has limited demand for batteries manufactured in the United States. As the US dollar appreciates, batteries manufactured in the United States become more expensive in international markets. Nevertheless, industry exports are expected to rise at an annualized rate of 4.9% to $3.9 billion over the five years to 2019. Large companies have the research and development capabilities to offer cutting-edge industry products, which has boosted demand from foreign consumers. Emerging automobile markets in countries have also contributed to the rise in exports. For the United States, exports consist primarily of rechargeable batteries. Lithium-ion batteries and lead-acid batteries used for starting engines are the top two exported battery types from the United States.

Over the five years to 2019, imports are expected to rise at an annualized rate of 12.1% to $7.5 billion, threatening industry competitiveness. Imports' share of domestic demand has been on the rise during the period, increasing from 30.9% in 2014 to 44.6% in 2019. Emerging economies have significantly expanded their manufacturing capabilities and reach. Low-wage countries such as China and Mexico all have a cost advantage in producing batteries. Consequently, imports from these countries rose during the period and pushed down battery prices. As prices have declined during the five-year period, IBISWorld expects industry profit to decline in 2019, accounting for an estimated 3.8% of industry revenue.

For the United States, exports consist primarily of rechargeable batteries

Industry structure

Even amid high import competition, falling battery prices and some notable barriers to entry, IBISWorld expects industry enterprises to increase an annualized 4.0% to 190 companies over the five years to 2019. The number of companies is expected to increase largely due to rebounding industry revenue in 2017. As the number of companies increased during the five-year period, employment rose at an annualized rate of 3.9% to 30,324 employees. The average industry wage also rose during the period from $63,704 in 2014 to $69,621 in 2019 as companies require skilled employees to research and develop more-advanced types of batteries.

Operators that produce primary batteries have undergone significant restructuring. For example, Energizer Holdings Inc. (Energizer) announced in April 2014 that it would separate its household products division from its personal care products, forming two publicly traded companies. In November 2014, the Procter and Gamble Company announced the sale of its Duracell Inc. business to Berkshire Hathaway Inc. The spinoff and acquisition have significantly altered the primary battery production ownership landscape; however, such restructurings are not anticipated to significantly affect overall industry performance. Most recently, major player Spectrum Brands Holdings Inc. announced the sale of its global battery and lighting division to Energizer. The transaction closed during the first quarter of 2019.

Industry Performance

Industry Outlook

The Battery Manufacturing industry is expected to experience growth over the five years to 2024. Demand from automobile manufacturers will remain low, although there is expected to be a slight resurgence in demand over the five years to 2024. Meanwhile, the continuing technological advancement and shift to more automated vehicles will likely require new, more advanced batteries. As current economic conditions continue, consumer spending on electronics that require batteries is expected to continue growing, boosting demand for industry products.

Additionally, over the five years to 2024, stagnation in the value of the US dollar will bolster export growth. To remain competitive on a global scale, operators will increase their research and development expenditure to provide price-premium products, such as hybrid batteries. Overall, industry revenue is anticipated to rise at an annualized rate of 1.2% to $14.1 billion over the five years to 2024. However, an expected increase in the price of certain nonferrous metals will hamper profit growth in the future and cause a slight decrease in the average industry profit margin.

Seeing green

Demand is expected to rise within the rechargeable battery segment, which mainly services consumer electronics and automotive manufacturing industries. Over the next five years, demand for hybrid-electric vehicles is anticipated to grow in response to heightened environmental awareness and the introduction of new types of vehicles, such as electric-powered bikes and motorcycles. According to the US Energy Information Administration's 2019 Annual Energy Outlook, an increasing number of light-duty vehicles are powered with fuel-efficient systems. For example, between 2018 and 2050, sales of battery-powered electric vehicles are expected to increase from 2.1% to 14.2% of total light-duty vehicle sales in the United States. Additionally, by 2025, sales of light-duty battery electric, plug-in hybrid electric and hydrogen fuel cell vehicles are expected to account for 6.7% of total light-duty vehicle sales.

Historically, high battery costs and a lack of accompanying infrastructure, such as charging stations, have kept electric vehicles from gaining widespread popularity. According to *Quartz*, batteries are the single most-expensive component of electric vehicles. However, decreasing

Demand is expected to rise within the rechargeable battery segment

battery prices are expected to spur demand for alternative-energy vehicles. Companies such as luxury automotive manufacturer Tesla Inc. (Tesla) have been making investments to bring down the price of lithium-ion batteries used in electric vehicles. For example, Tesla's Gigafactory in Nevada has a production rate of nearly 500,000 electric cars, requiring a significant and increasing share of lithium-ion batteries. As electric vehicle production ramps up, producing batteries in mass quantity will drive down prices even further. By 2020, Tesla's factory could produce batteries with an average price as low as $100.00 per kilowatt-hour (KWh), according to David Keith, a professor at the Massachusetts Institute of Technology (MIT) that studies automotive technology.

Despite falling prices of lithium-ion batteries, operators will continue to focus on lithium-ion batteries due to their premium over traditional products such as primary batteries. However, premiums

Industry Performance

Seeing green continued

are expected to remain low as the price of lithium-ion batteries continues to fall over the five years to 2024. Due to faltering demand for nonrechargeable primary batteries, such as alkaline batteries, manufacturers will have to reposition their products by devoting more resources to product promotion and distribution networks. Additionally, primary battery manufacturers will need to emphasize their products' reliability and utility, especially in emergency situations. To gain market share, manufacturers will also likely follow Duracell Inc.'s lead with its Smart Power Duracell campaign to position company products as environmentally conscious. In a saturated market, companies are increasingly differentiating themselves as environmentally friendly to leverage consumers' environmental consciousness and increase sales.

Enterprises and wages on the rise

In the wake of increasing revenue, barriers to entry will play a key role in preventing the industry from becoming oversaturated. High research and development costs needed to keep up with changing technology, especially for energy-efficient batteries for car and automotive original equipment manufacturers (OEMs), is expected to deter new entrants. Consequently, the number of industry enterprises is expected to exhibit slower growth moving forward. IBISWorld expects the number of industry enterprises to rise an annualized 3.2% to 222 companies over the five years to 2024. These new entrants are expected to specialize and focus on breakthrough markets such as lithium-ion battery pack production. Additionally, consolidation is expected to continue as companies seek to offer lower prices and expand their product portfolios. This is reflected by the finalization of the acquisition of Spectrum Brands Holdings Inc.'s global battery and appliances segment by Energizer Holdings Inc. (Energizer), cementing Energizer's position in the industry.

Barriers to entry will play a key role in preventing the industry from becoming oversaturated

As demand rises for advanced energy-efficient batteries, companies will need to attract skilled employees to develop and produce the batteries. To attract talent, companies focused on research and development are expected to offer attractive financial incentives to experts in the field of battery chemistry and development. In particular, IBISWorld expects research and development expenditure to increase an annualized 2.5% over the five years to 2024. As research and development efforts gradually increase, IBISWorld expects industry wages to follow suit. Specifically, industry wages are expected to increase an annualized 1.7% to $2.3 billion over the five years to 2024.

Trade

Over the five years to 2024, IBISWorld projects the industry's trade deficit to abate given a more favorable trade-weighted index (TWI) as well as increased domestic production of lithium-ion batteries. In 2018, the TWI declined 10.7%, ending a several-year period of strength in the US dollar. As the value of the US dollar declines against other major currencies, US exports

Industry Performance

Trade continued

become more competitive in international markets. IBISWorld expects the value of the TWI to remain unchanged over the five years to 2024, largely promoting increased export activity. Little change in the TWI is also expected to make imports less competitive in domestic markets as domestic buying power has declined relative to the previous five-year period. In addition to a more favorable TWI, the increasing popularity of electric vehicles is expected to continue the trend of expanding lithium-ion battery production in the United States. Among the newest entrants to the industry, the majority of these entrants are involved in the production of lithium-ion batteries purposed for electric vehicles (see IBISWorld report OD4499, Lithium Battery Manufacturing).

Overall, a substantial decline in the growth of imports is expected over the next five years. IBISWorld forecasts total imports to increase an annualized 3.3% to $8.9 billion over the five years to 2024, representing slowed growth relative to the previous five-year period's 12.1% annualized growth. Additionally, exports are expected to increase an annualized 3.6% to $4.7 billion over the five years to 2024, representing only a minor slowdown in growth relative to the previous five-year period. As the Battery Manufacturing industry becomes more globalized, the industry's trade activity is expected to account for an increasing share of industry revenue. In particular, industry exports are forecast to rise from 29.5% of industry revenue in 2019 to 33.2% of industry revenue in 2024. Moreover, total imports are expected to increase from 44.6% of industry revenue in 2019 to 48.5% of industry revenue in 2024. In turn, import-penetration is projected to continue over the next five years, albeit at a slower pace than the previous five-year period.

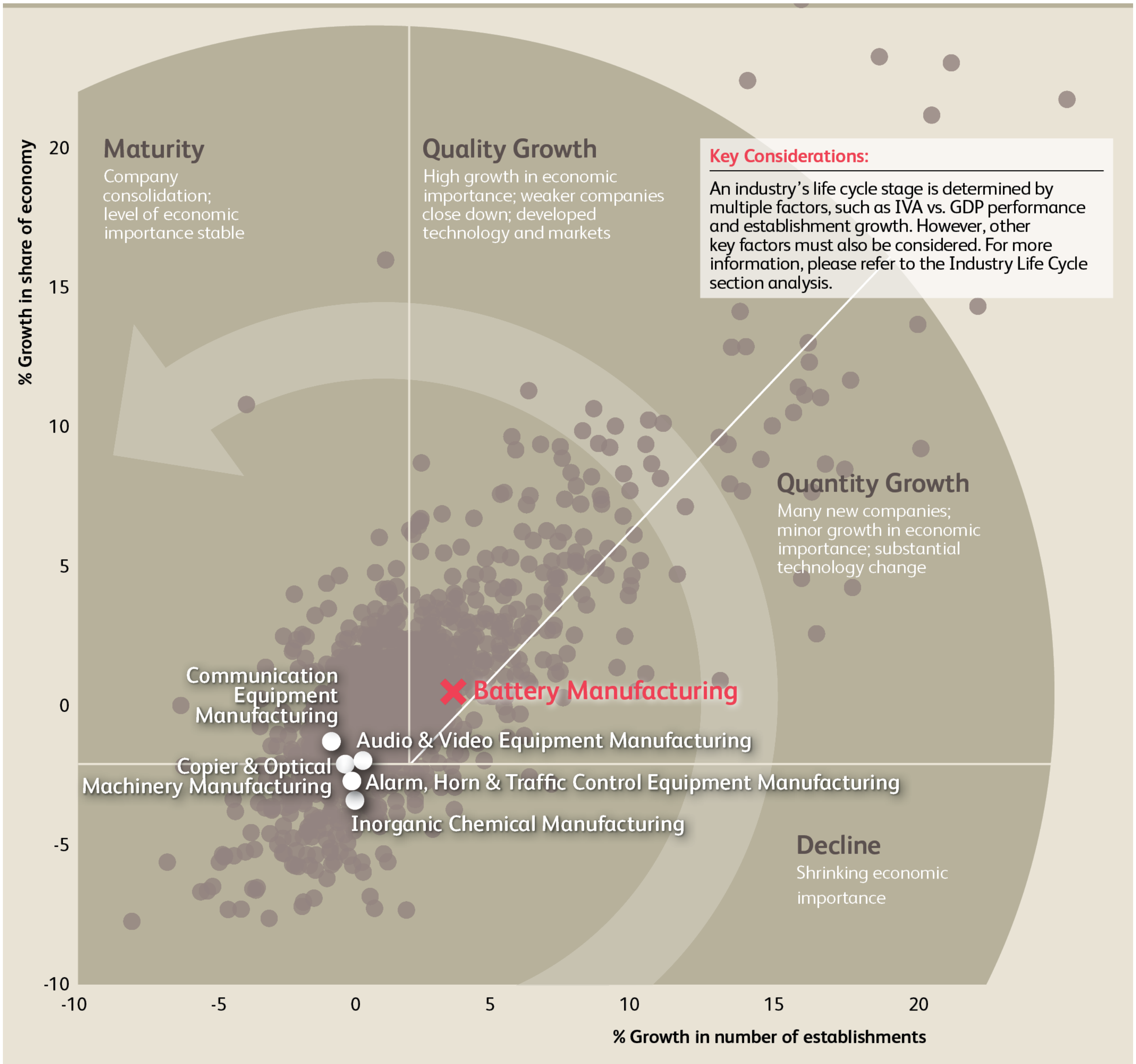
Industry Performance

Life Cycle Stage

Growth of the number of establishments has slowed

The industry has clearly defined product segments

The market is saturated



SOURCE: WWW.IBISWORLD.COM

Industry Performance

Industry Life Cycle

This industry is **Mature**

The Battery Manufacturing industry is in the mature phase of its industry life cycle. Characteristics that identify this life stage include clear product segmentation, strong acquisition activity and market saturation. Over the 10 years to 2024, industry value added (IVA), a measure of the industry's contribution to the overall economy, is expected to increase at an annualized rate of 2.6%. Comparatively, US GDP is forecast to grow at an annualized rate of 2.1% during the period. While IVA is expected to outpace GDP growth, this is predominantly due to the volatile nature of the industry (due to its notable exposure to commodity prices) and high import competition.

While there have been technological improvements in industry products, they still fall under clearly segmented categories and are sold to the same downstream industries and consumer markets. The number of establishments in this industry is projected to increase at an annualized rate of 3.6% over the 10 years to 2024. Relatively stable establishment figures reflect the mature and saturated markets served by industry operators.

Industry consolidation is another strong indicator of maturity. Major player EnerSys Inc. has acquired multiple US companies over the past five years to reduce competition and grow its production size. Most recently, major industry player Spectrum Brands Holdings Inc. has exited the industry following the sale of its battery segment to Energizer Holdings Inc. during the first quarter of 2019. Due to the need to constantly improve products to stay competitive, acquisitions can be an extremely cost-effective way to improve technology and expand a company's product portfolio. Additionally, operators benefit from vertical integration, both upstream and downstream, due to declining average industry profit margins and increasing competition over the 10 years to 2024. For instance, Tesla Inc., which sells luxury electric cars, in partnership with Panasonic Energy of North America created a vertically integrated battery pack facility to decrease the per kilowatt-hour cost of their battery packs. By decreasing the price of its lithium-ion batteries, Tesla has been able to expand into new markets, such as storage battery stations for homes.

Products & Markets

Supply Chain | Products and Services | Demand Determinants
Major Markets | International Trade | Business Locations

Supply Chain

KEY BUYING INDUSTRIES

33331	**Copier & Optical Machinery Manufacturing in the US**	Photographic cameras require products manufactured by this industry.
33422	**Communication Equipment Manufacturing in the US**	Cellular phones require products manufactured by this industry.
33429	**Alarm, Horn & Traffic Control Equipment Manufacturing in the US**	Smoke detectors and other alarms require products manufactured by this industry.
33431	**Audio & Video Equipment Manufacturing in the US**	Handheld video cameras require products from this industry.
33611a	**Car & Automobile Manufacturing in the US**	Cars and automobiles use lead-acid storage batteries.
33611b	**SUV & Light Truck Manufacturing in the US**	Cars and trucks use batteries.
33612	**Truck & Bus Manufacturing in the US**	Participants in this industry demand storage batteries.
33993	**Toy, Doll & Game Manufacturing in the US**	Battery operated dolls, games and toys require products manufactured by this industry.
81111	**Auto Mechanics in the US**	Mechanics require replacement batteries for the cars they repair.

KEY SELLING INDUSTRIES

32518	**Inorganic Chemical Manufacturing in the US**	Companies in this industry supply battery manufacturers with inputs for the production process.
32619	**Plastic Products Miscellaneous Manufacturing in the US**	Plastic is used as an input for the production of a variety of battery shells. For example, automotive battery cases, cellular phone battery shells and selected dry cells.
33141	**Nonferrous Metal Refining in the US**	Copper, zinc and lead are key metal inputs used to manufacture batteries.
33149	**Nonferrous Metal Rolling & Alloying in the US**	This industry supplies metal for use in battery manufacturing.
33211	**Metal Stamping & Forging in the US**	This industry supplies metal products to battery manufacturers.
42351	**Metal Wholesaling in the US**	Battery manufacturers purchase nonferrous metals from wholesalers for use in manufacturing.

Products and Services

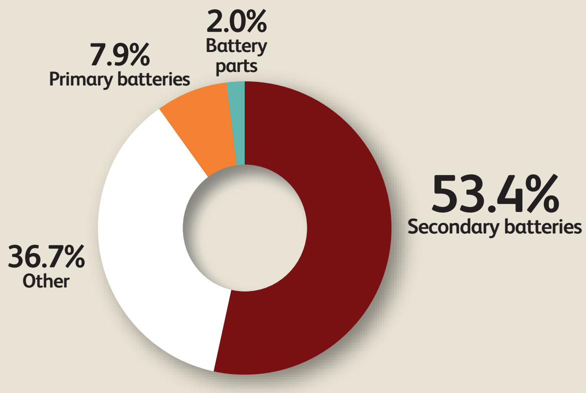
Secondary batteries

Lead acid batteries were the first rechargeable battery for commercial use. This battery type is dependable and inexpensive on a cost-per-watt base. Lead batteries also have a wide array of application, such as for automobiles, golf cars, forklifts, marine and uninterruptible power supplies. The majority of these batteries are for automobile starting, lighting and ignition (SLI) application. In addition to lead acid batteries, lithium-ion batteries are also included in this product segment. Lithium-ion batteries are primarily used to power electric vehicles and portable devices. Industry operator Panasonic Energy of North America is the largest producer of lithium-ion battery packs in the United States and is expected to expand

Products & Markets

Products and Services continued

Products and services segmentation (2019)



Total $13.3bn

SOURCE: WWW.IBISWORLD.COM

production over the five years to 2024. Due to their wide applicability, dependability and low cost, secondary batteries comprise the highest value of industry shipments at 53.4%.

Primary batteries

Primary batteries are designed to be used once and then discarded. Primary batteries account for an estimated 7.9% of industry products in 2019, slight decrease during the period. The decline in this segment can be associated with environmental concerns about these batteries. They contain heavy metals and strong acids, require separate disposal systems and require a high amount of energy to manufacture them. Additionally, as more environmentally friendly rechargeable batteries become more efficient and cost-effective, they will likely overtake these one-use batteries. However, primary batteries will likely remain in use for high-priority applications where function needs to be ensured such as for smoke detectors and flashlights.

Other

The remaining products in the industry mostly comprise various inputs and parts. This segment generates an estimated 36.7% of industry revenue and has increased during the five-year period as batteries have become increasingly complex. This has resulted in more-expensive and -technically complex inputs, which have generated a higher percentage of industry revenue due to this rising complexity.

Demand Determinants

Electric vehicles

Demand for electric vehicles is among the most significant drivers of demand for domestic battery production. The increased popularity of electric vehicles has spurred domestic investment in lithium-ion battery manufacturing. In particular, Tesla Inc.'s partnership with Panasonic Energy of North America has exemplified this trend as the companies have successfully vertically integrated the production of electric vehicle battery packs. In addition, industry operators LG Chem Michigan Inc. and Samsung SDI Co. Ltd. have both expanded their operations over the past five years.

Products & Markets

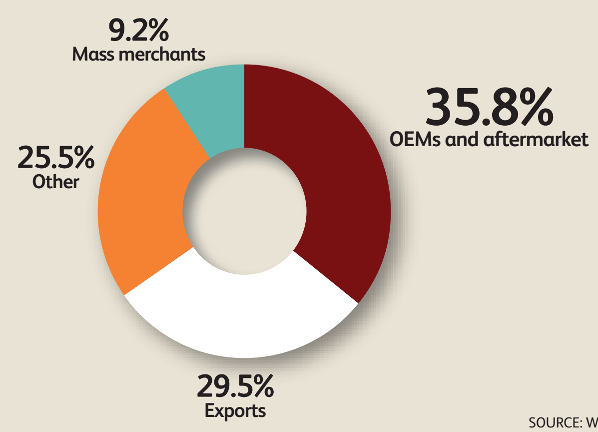
Demand Determinants continued

Consumer electronics

Demand for consumer electronics also represents a significant source of demand for the industry's products. In particular, increased demand for electronics and other consumer discretionary purchases drives sales of primary batteries (single-use batteries typically of an alkaline chemistry). The most common types of primary batteries are AAA and AA batteries due to their small size, versatility and cost-effectiveness. Furthermore, demand for consumer electronics is determined by consumer income levels and sentiment. As unemployment has declined and inflation has remained subdued, per capita disposable income is expected to increase over the five years to 2019. As consumer incomes continue to increase, consumption of electronics and other battery-powered products is expected to increase.

Major Markets

Major market segmentation (2019)



The Battery Manufacturing industry sells various types of batteries to several downstream industries, such as automotive, medical device, audio and video equipment, electronics and telecommunication equipment manufactures. The industry also sells directly to consumers through various retail and wholesaling channels and foreign markets.

Original equipment manufacturers and aftermarket

Original equipment manufacturers (OEMs) use batteries as inputs in products. A variety of industrial and consumer OEMs use industry products as inputs. Industrial products that use batteries as inputs include telecommunications, industrial lifting, energy generation equipment, trains and energy generation equipment. Consumer products include laptops, cellphones, cars, motorcycles, iPads and a wide variety of other products. Automotive OEMs are expected to be the largest OEM group. Automotive OEMs manufactures require batteries that generate high amounts of power, have low operating temperatures and are safe. Lead-acid batteries are currently used in these applications. Developments in electrically powered vehicles that use batteries to replace the combustion engine are expected to gain growing acceptance as environmental concerns increase. The

Products & Markets

Major Markets continued

development of the fast-growing hybrid-electric vehicle market will continue leading demand for high-power lithium-ion batteries.

Once batteries used as inputs need replacing, companies and consumers can replace them by purchasing batteries from mass merchandisers or via the aftermarket. The aftermarket usually consists of batteries for cars, cell phones, laptops and other electronics. Automotive batteries are the biggest segment of the aftermarket. These are primarily sold by auto parts retailers such as Pep Boys and AutoZone. The number of motor vehicles in use has been rising over the past five years and will continue to grow in the future, boosting this segment's share of revenue. Altogether, OEMs and the aftermarket are expected to generate 35.8% of industry revenue in 2019.

Exports

Exports have been growing as a share of revenue over the past five years and are expected to account for 29.5% of industry revenue in 2019. Demand for industry products abroad has continued to rise despite appreciation of the US dollar, which has made US goods more expensive on the global market. Exports are expected to continue to account for a significant share of industry revenue over the next five years as operators develop innovative batteries that leverage growing demand for energy-efficient batteries. Additionally, the economic development of countries such as China and India will spur demand for cars and consumer electronics, increasing the need for batteries from downstream manufacturers.

Mass merchants

Primary batteries used in household goods are generally sold through mass merchants such as Walmart. Drug and grocery stores also sell primary batteries. Battery types sold in this market include primary cells for portable low-power products such as watches, meters, cameras, toys and calculators. Non-rechargeable lithium batteries are most commonly used in these applications nowadays, though power tools, flashlights and personal wireless electrical equipment are increasingly using storage batteries. Demand from this market has been rising over the past five years as consumer spending increased. This segment accounts for an estimated 9.2% of industry revenue and is expected to continue expanding over the next five years as consumer spending rises.

Products & Markets

International Trade

Level & Trend
Exports in the industry are **High** and **Increasing**

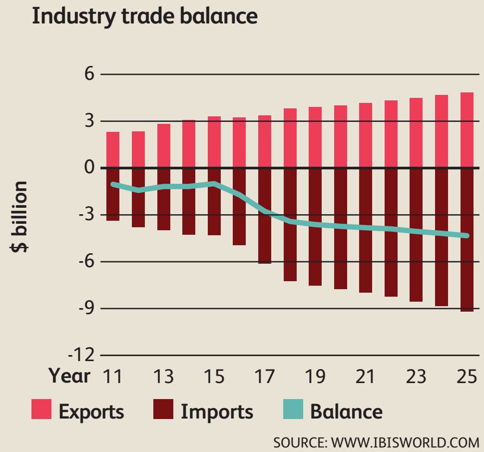
Imports in the industry are **High** and **Increasing**

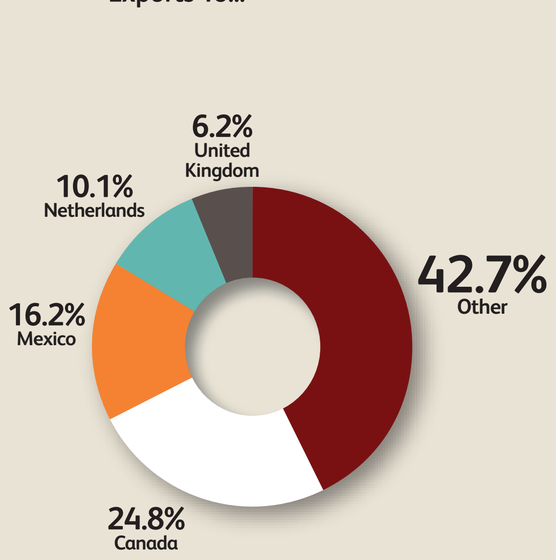
Imports

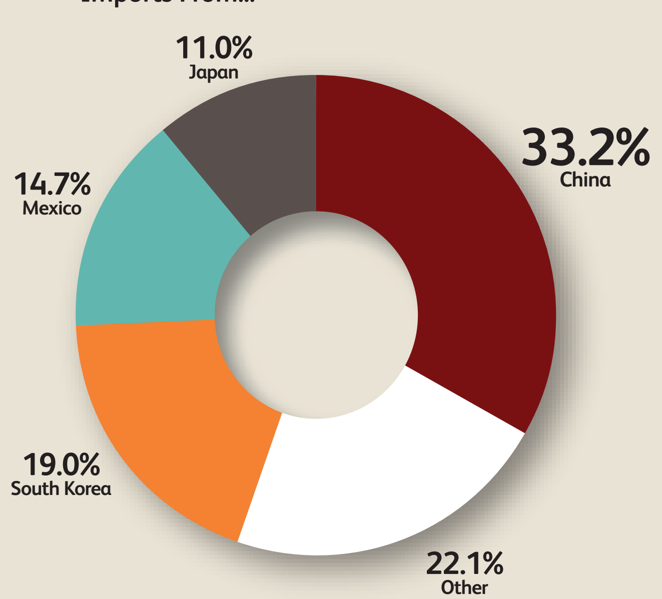
Imports are expected to grow at an annualized rate of 12.1% to $7.5 billion over the five years to 2019, satisfying 44.6% of domestic demand. Foreign operators such as China benefit from low-wage costs and are able to export products at competitive prices. Appreciation of the US dollar over the five years to 2019 has reduced the relative cost of imports and benefited foreign-made batteries. China, South Korea, Mexico and Japan account for 33.2%, 19.0%, 14.7% and 10.9% of total imports respectively. During the period, imports from low wage countries such as China, Mexico and South Korea grew substantially while imports from Japan increased marginally.

Exports

Over the five years to 2019, IBISWorld expects industry exports to increase at an annualized rate of 4.9% to $3.9 billion. Exports share of industry revenue is forecast to increase from 24.4% of industry revenue in 2014 to 29.5% of industry revenue in 2019. As low-cost imports continue to cut into industry revenue, operators have increasingly focused on price-premium battery exports, such as lead-acid batteries for other uses such as electrical vehicles and lithium-ion used in automotive manufacturing to increase







Year: 2019

SIZE OF CHARTS DOES NOT REPRESENT ACTUAL DATA

SOURCE: USITC

Products & Markets

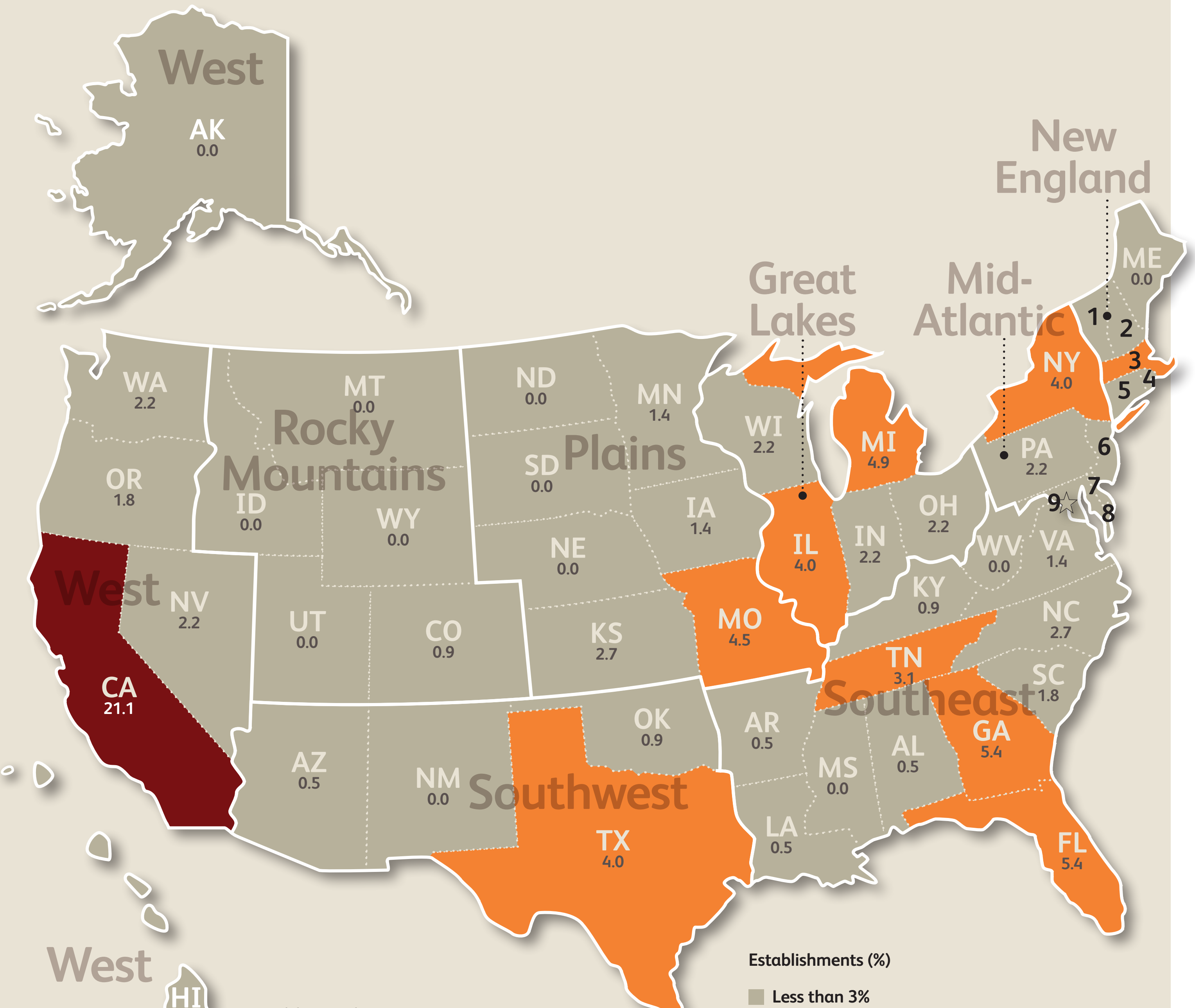
International Trade continued

revenue. Although the price of these batteries has decreased, they are still technologically advanced and command a premium over less-technical batteries such as primary batteries; therefore, the United States maintains a competitive advantage in their production.

The major export destinations for the Battery Manufacturing industry include Canada, Mexico, the Netherlands and the United Kingdom, which account for an estimated 24.8%, 16.2%, 10.1% and 6.2% of total exports in 2019. Exports to Canada have increased slightly during the period; however, exports to Mexico, the Netherlands and the United Kingdom have grown at moderately high rates during the five-year period.

Products & Markets

Business Locations 2019



Additional States (as marked on map)

1 VT	2 NH	3 MA	4 RI	
0.5	0.0	7.2	0.9	
5 CT	**6 NJ**	**7 DE**	**8 MD**	**9 DC**
0.9	1.4	0.9	0.9	0.0

Establishments (%)

- Less than 3%
- 3% to less than 10%
- 10% to less than 20%
- 20% or more

SOURCE: WWW.IBISWORLD.COM

Products & Markets

Business Locations

Proximity to downstream markets is an important competitive strategy in this industry. Companies often benefit from cluster formations as this facilitates access to new technological innovations. IBISWorld research indicates that in general, there is a concentration of companies near population and automotive hubs, as well as close to consumer electronics manufacturers.

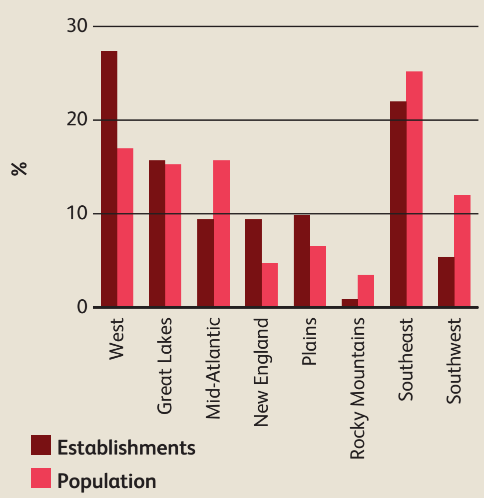
Southeast

The Southeast, which is the most populous region, is the second-most significant location for companies in this industry, expected to account for 22.0% of industry establishments. The Southeast region is also an automotive hub, where the Japanese automotive manufacturers, such as Toyota, are located. Additionally, the Southeast is ideally situated next to the Gulf of Mexico, facilitating inexpensive and efficient maritime transport to Mexico, a top buyer of industry products.

West

The West accounts for the highest percentage of industry establishments, totaling 27.4%. This region is highly populated. California alone accounts for 21.1% of all establishments. There are several top-tier engineering schools located in California, which results in a high supply of qualified labor. Also, key input industries are located in the West, enabling inexpensive transport of necessary materials used in manufacturing batteries.

Distribution of establishments vs. population



SOURCE: WWW.IBISWORLD.COM

Great Lakes

Automotive hubs tend to locate in the Great Lakes region, which is home to Michigan-based GM, Ford and Chrysler, three downstream companies that are often referred to as the big three. Also, the Great Lakes grant efficient maritime transport to Canada, the biggest buyer of industry products. Consequently, Michigan is home to 4.9% of industry establishments. The Great Lakes' economy was severely affected during the recession along with battery manufacturers, and many companies across a variety of industries had to close down. However, the Great Lakes region still accounts for 15.7% of industry establishments.

Competitive Landscape

Market Share Concentration | Key Success Factors | Cost Structure Benchmarks
Basis of Competition | Barriers to Entry | Industry Globalization

Market Share Concentration

Level
Concentration in this industry is **Low**

The Battery Manufacturing industry exhibits a moderate level of market share concentration, with the top four companies estimated to account for 51.4% of industry revenue in 2019. Market share concentration has increased during the period, largely due to acquisition activity. This trend is expected to continue over the five years to 2024 and is exemplified by the recent sale of Spectrum Brands Holdings Inc.'s battery division to major player Energizer Holdings.

IBISWorld estimates that the level of concentration will continue to be at a low level over the next five years. High start-up capital costs deter most potential entrants. Additionally, strong relationships between larger companies and their downstream customers, such as Walmart and major OEMs, could prove to be a barrier by limiting the number of potential customers for new manufacturers. Additionally, price is becoming an increasingly important factor in the market, as the price of high-tech batteries, such as lithium-ion batteries, have fallen over the years and are expected to continue to decrease over the five years to 2024. Consequently, larger companies that can achieve efficient economies of scale are better positioned to compete in an increasingly price competitive market than newer entrants that may not be able to achieve the same economies of scale.

Key Success Factors

IBISWorld identifies 250 Key Success Factors for a business. The most important for this industry are:

Access to highly skilled workforce
A skilled staff is required to design and develop industry products as consumers demand more efficient and environmentally friendly batteries.

Economies of scale
Large-scale operations are generally more profitable because they enable for economies of scale, lower per-unit production costs due to larger size, to be achieved.

Mitigating volatility of input prices by entering into contracts
The prices of raw materials such as lead, zinc, copper and steel have been volatile. Consequently, manufacturers need to develop strong relationships with suppliers to ensure the availability of high-quality raw materials at competitive prices.

Access to the latest available and most efficient technology and techniques
Companies need access to technological developments and must be able to adopt new technology quickly to remain competitive.

Effective quality control
Customers often purchase goods manufactured by this industry based on product performance and quality. Thus, it is important that battery production meets the required quality standards.

Undertaking technical research and development
The level of expenditure on research and development within the company has to increase with the growth of product segments and evolving consumer requirements.

Competitive Landscape

Cost Structure Benchmarks

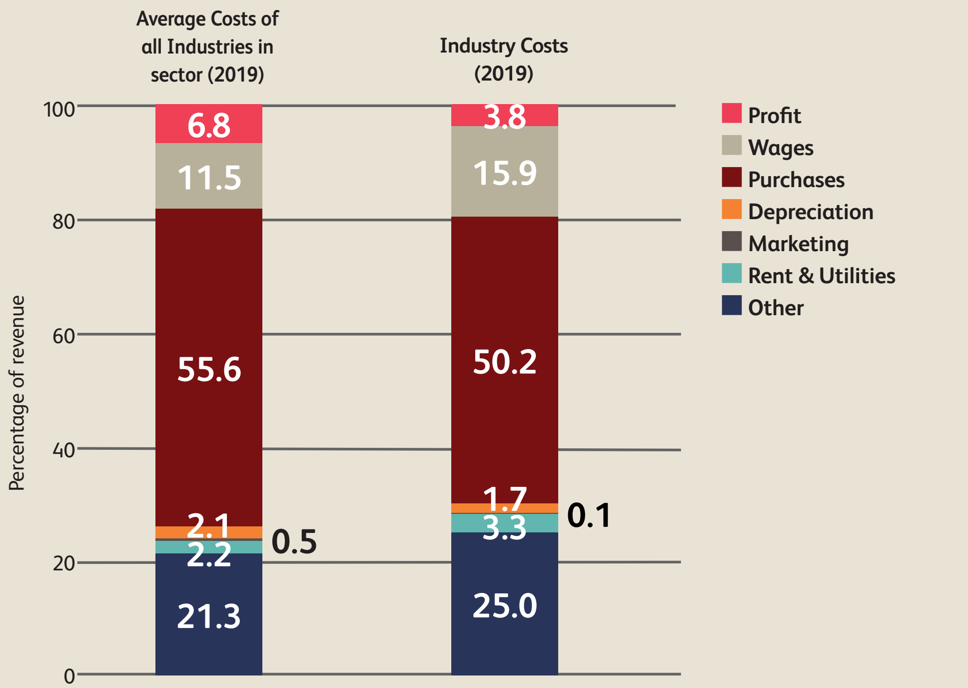
Profit
Profitability in the Battery Manufacturing industry varies according to a company's size and the products it produces. Large companies benefit from higher profit margins due to lower per-unit production costs and storage and superior-performance primary batteries provide the greatest returns. IBISWorld estimates that average profit, measured as earnings before interest and taxes, accounts for 3.8% of revenue in 2019. During the five-year period, profit has decreased due to falling prices of certain types of batteries.

Purchases
Purchases are the largest expense for the Battery Manufacturing industry and are forecast to account for 50.2% of revenue in 2019. Goods purchased include various metals, chemicals, carbon and plastics. Lead is a major input for manufacturers. During the period, the price of nonferrous metals has declined, leading to a decrease in purchase costs. However, due to the volatility of the mining industry, these costs are expected to increase over the five years 2024.

Wages
Wages are estimated to account for 15.9% of revenue in 2019. Wages have increased as a percentage of revenue, reflecting higher average wages as operators aim to outcompete competitors with cutting-edge products that require skilled labor to produce. However, increased automation through machinery and software has enabled some companies to expand production with minimal additional hires.

Other
Depreciation is expected to increase from 1.4% of industry revenue in 2014 to

Sector vs. Industry Costs



SOURCE: WWW.IBISWORLD.COM

Competitive Landscape

Cost Structure Benchmarks continued

1.7% of industry revenue in 2019. Increased automation among new entrants to the industry has increased the industry's capital intensity, resulting in heightened depreciation expenses for the industry.

Rent and utilities are estimated to account for 3.3% of industry revenue 2019, representing a slight decline from 4.3% of industry revenue in 2014. This decline is attributable to more industry operators opting to purchase manufacturing facilities outright as oppose to lease given low interest rates and readily available credit.

Other costs include marketing, administrative, transportation, warranties on products and research and development (R&D) costs. Manufacturers have concentrated their R&D efforts toward developing batteries that are safer, lighter and have a higher energy density, thereby justifying the significant proportion of revenue this category absorbs. Altogether, other costs are projected to account for 25.0% of revenue in 2019.

Basis of Competition

Level & Trend
Competition in this industry is **Medium** and the trend is **Steady**

Internal competition

Technological innovation, quality, price, branding, environmental friendliness and service drive internal competition in this industry. Technological innovation is important because consumers are increasingly demanding longer-lasting batteries. Consumers prefer batteries that are technologically advanced over other products. Investment in research and development is important in setting one company apart from the rest. At the same time, manufacturers need to meet quality standards to retain consumers. High-performing and reliable batteries are important, especially given the critical nature of some of the downstream industry activities that demand these batteries. These include medical products such as pacemakers and hearing aids and automotive products such as heavy-duty vehicle batteries.

Price plays an important role in determining final purchase decisions by original equipment manufacturers and consumers. This is particularly true for widely available general-purpose batteries. During the five-year period, price is becoming increasingly important as the price of certain types of batteries, such as lithium-ion batteries, decreases and low-costs imports increase. However, companies with strong brands are often able to charge more for their products. Existing and established companies that offer a wide range of quality products maintain market presence and gain better new-product acceptance than lesser-established companies. Longer battery warranties by manufacturers create an advantage over competitors and enable companies to charge higher prices. Companies can also compete by providing additional after-sales service.

Environmental awareness is an important issue in modern society and directly affects this industry as used batteries create enormous waste. Therefore, batteries that have a high recyclable component are often favored over non-recyclable varieties, provided they perform equally. Given the highly toxic nature of some of the byproducts of battery manufacturing, companies set themselves apart by promoting themselves as environmentally conscious to an increasingly aware public.

External competition

External competition also exists in this industry from the development of alternative energy storage systems such as use of natural gas, wind and sunlight. However, alternative energy competition is not intense because these systems are not yet developed into feasible

Competitive Landscape

Basis of Competition continued

substitutes. Furthermore, batteries manufactured abroad compete with domestically produced batteries. Import penetration for competitively priced imports from low-wage countries is expected to increase over the five years to 2019 as the relatively high value of the US dollar makes imports an attractive and low-cost substitute for domestically produced batteries.

Barriers to Entry

Level & Trend
Barriers to Entry in this industry are **High** and **Steady**

The large players in this industry are well established, with a wealth of technical and market knowledge acquired over decades of operation. Newcomers, usually having a lack of experience, will find it difficult to enter an industry that is well established and involves a product where the pace of technical innovation is rapid. The need for ready access to the latest knowledge, machinery and skilled staff is paramount but equally time-consuming to establish.

The capital investment requirement is also high for this industry, illustrating the reliance of battery manufacturing on machinery. Therefore, capital start-up costs are relatively substantial. On top of machinery, new entrants will also have to attract skilled workers.

The top four major players in this industry account for a low but growing share of revenue and benefit from strong consumer preference. This market dominance by existing participants will push new entrants to invest heavily in marketing campaigns to establish industry links and gain consumer recognition. Further, the heavy patenting in this industry also creates a barrier to entry.

Established companies have the benefit of producing at reduced unit costs, given the large-scale at which they operate. This sizeable scale of operation also increases negotiating power when purchasing raw materials and arranging credit terms, further reducing production costs. Newcomers will not immediately have these efficiencies, which could act as a deterrent for prospective companies.

This industry thrives on technical advances to existing products, with competitors setting themselves apart from others with such advances. The continual patenting that exists in the industry is reflective of this importance of technical advances. New entrants may not have established research and development resources. It may take years for them to acquire any innovation and a competitive edge, during which time heavy investment in research and development must nonetheless continue.

Barriers to Entry checklist

Competition	Medium
Concentration	Low
Life Cycle Stage	Mature
Capital Intensity	Low
Technology Change	High
Regulation and Policy	Heavy
Industry Assistance	Medium

SOURCE: WWW.IBISWORLD.COM

Competitive Landscape

Industry Globalization

Level & Trend
Globalization in this industry is **High** and the trend is **Increasing**

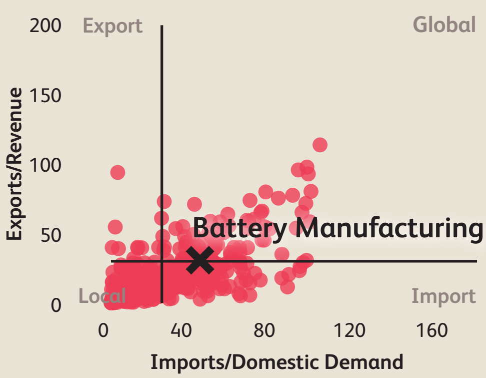
The Battery Manufacturing industry has a high level of globalization, with most of the US battery manufacturers owning subsidiaries and plants overseas through mergers and acquisitions. Major player Johnson Controls International PLC manufactures a large percentage of its batteries overseas. Even smaller players, such as EnerSys Inc., have manufacturing facilities abroad. Additionally, most US companies sell their products abroad. A combination of market saturation and slower population growth in most industrialized markets has caused a renewed focus toward selling industry products to developing countries. These countries, such as Mexico, China and South Korea, have increasing per capita income, in turn propelling demand for consumables such as cars, mobile phones and other battery-consuming products. Although industry operators may not export batteries directly to these countries, their products could still be used by original equipment manufacturers (OEMs) that export their products to developing countries. Therefore, as demand for consumables increases, so does demand for batteries.

International trade is a major determinant of an industry's level of globalization.

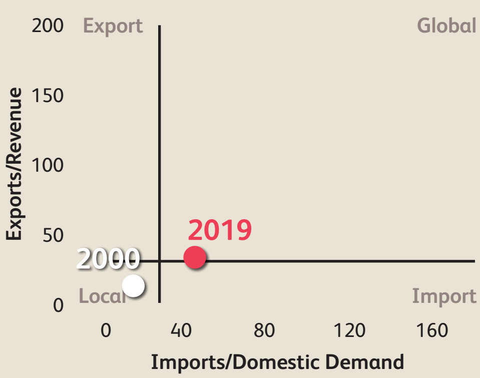
Exports offer growth opportunities for firms. However there are legal, economic and political risks associated with dealing in foreign countries.

Import competition can bring a greater risk for companies as foreign producers satisfy domestic demand that local firms would otherwise supply.

Trade Globalization



Going Global: Battery Manufacturing 2000–2019



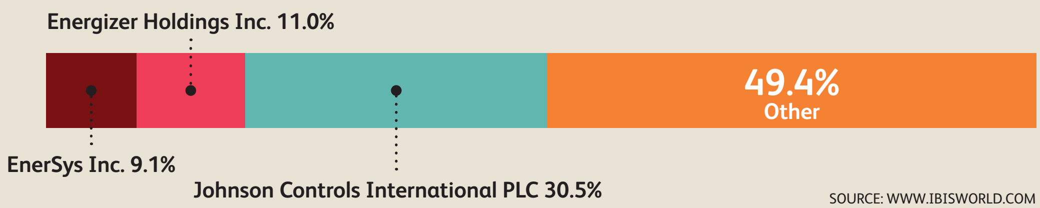
SOURCE: WWW.IBISWORLD.COM

Major Companies

Johnson Controls International PLC | Energizer Holdings Inc. EnerSys Inc. | Other Companies

Major Players

(Market Share)



SOURCE: WWW.IBISWORLD.COM

Player Performance

Johnson Controls International PLC
Market Share: 30.5 %
Industry Brand Names
Varta
Optima

Johnson Controls International PLC (Johnson Controls) manufactures car batteries and interior parts for hybrid-electric and other vehicles, as well as energy-efficient systems for commercial buildings. Founded in 1885, Johnson Controls' North America division is headquartered in Milwaukee and operates three primary businesses: building efficiency, automotive experience and power solutions. Only the power solutions business contributes to industry-specific revenue because this segment is responsible for designing and manufacturing automotive batteries for the replacement and original equipment manufacturer (OEM) markets. Currently, the company is the largest producer of lead-acid automotive batteries in the world. Retailers that sell Johnson Controls' batteries include Advance Auto Parts, AutoZone, Costco, National Automotive Parts Association (NAPA), O'Reilly Auto Parts, Interstate Battery System of America, Sears and Walmart stores. Johnson Controls sells batteries mainly under the Varta and Optima brands in the United States, LTH in Mexico and Heliar in South America. Johnson Controls generated total company revenue of $31.4 billion during the company's 2018 fiscal year, which ended in September 2018.

As demand for fuel-efficient, lower-emission vehicles increases in developed economies, Johnson Controls is expanding its expertise in green energy. In June 2016, the company announced a $245.0 million investment to expand its absorbent glass mat (AGM) battery manufacturing output in the United States and $200.0 million to building a new plant in China. Improving AGM technology increases fuel efficiency and

Johnson Controls International PLC (US industry-specific segment) - financial performance*

Year**	Revenue ($ million)	(% change)	Operating Income ($ million)	(% change)
2013-14	1,755.0	N/C	218.8	N/C
2014-15	1,874.4	6.8	255.1	16.6
2015-16	2,557.3	36.4	338.0	32.5
2016-17	3,732.4	46.0	526.7	55.8
2017-18	3,927.4	5.2	569.7	8.2
2018-2019**	4,045.1	3.0	696.2	22.2

*Estimates; **Year-end September

SOURCE: ANNUAL REPORT AND IBISWORLD

Major Companies

Player Performance continued

savings. The company has also made investments in lead and polyrecycling operations in North America and European markets. Furthermore, the company is touting its battery circular economy process, wherein the company uses a closed-loop system for designing, building, recovering and recycling vehicle batteries.

The company is also poised to expand its United States based manufacturing presence. The company operates a 333,000.0-square-foot manufacturing facility in Walkertown, NC that employs more than 400 full-time employees. The company is looking to further expand production of AGM batteries, which would merit an investment of $33.0 million into machinery and equipment. The local government would also contribute up to $465,000 to Johnson Controls during a five-year period to assist in the expansion.

Financial performance

Over the five years to fiscal 2019 (year-end September), Johnson Controls is expected to continue experiencing growing demand from car and automobile manufacturing. Recently, the company has made investments to improve its AGM batteries for start-stop vehicles and lithium-ion batteries for hybrid and electric vehicles. These investments have enabled the company to better meet the need for more fuel-efficient cars and the increasing popularity of gas-electric hybrid and fully electric cars. IBISWorld expects Johnson Controls to continue growing as demand for electric cars increases. Consequently, the company's US industry-specific revenue is forecast to grow at an annualized rate of 18.2%, largely as a result of its acquisition activity, to an estimated $4.0 billion in fiscal 2019. Johnson Controls' US industry-specific profit also benefited from cost-reduction initiatives during fiscal 2018. The company's initiatives to the vertical integration of its battery-recycling facilities and a more-favorable product mix are expected to continue improving the company's margins.

Player Performance

Energizer Holdings Inc.
Market Share: 11.0 %
Industry Brand Names
Energizer
Eveready

Founded through a spinoff from Edgewell Personal Care Company in July 2015, Energizer Holdings Inc. (Energizer) manufactures batteries, battery chargers and portable lighting products. The company's roots reach back to 1905, when the company was founded as the Eveready Battery Company. Internationally, Energizer sells its products in more than 150 countries. During fiscal 2018 (year-end September), the company generated $1.8 billion in total company revenue.

The company classifies its sales under two segments: batteries and other. Within the battery-manufacturing segment, Energizer regularly updates and launches improved battery products, such as lithium batteries. Lithium batteries provide more power for high-tech products with faster computing chips, such as MP3 players. Energizer also produces flashlights and recently expanded its brands to include automotive fragrances and appearance products but sales from these products are not included in the industry. However, increasing sales of Energizer flashlights could have a positive influence on its battery sales through cross-selling products. In 2017, Energizer partnered with Colorado-based solar product provider PowerKeep to develop a state-of-the-art solar charging technology. The product, which does not include any batteries or plugs, signals that Energizer has diversified its product portfolio and has kept in mind the state of the Battery Manufacturing industry.

Major Companies

Player Performance continued

In January 2019, Energizer completed the acquisition the global battery and lighting segment of Spectrum Brands Holdings Inc. (Spectrum Brands) for an estimated $1.5 billion. The acquisition includes US-relevant manufacturing facilities that produce batteries and has significantly bolstered Energizer's market share in the Battery Manufacturing industry.

Financial performance

Over the five years to fiscal 2019, industry-specific revenue is expected to increase at an annualized rate of 9.2% to an estimated $1.5 billion. Overall, the company's financial performance has fluctuated significantly in response to volatile commodity prices and a brief decline in demand from emerging markets. However, Energizer's financial performance has largely rebounded from 2015 lows as commodity prices have stabilized and trade activity has increased. Overall, the company's financial performance has improved significantly in recent years as a result of the company's acquisition of Spectrum Brands' global battery and lighting segment. IBISWorld expects Energizer's revenue to increase 35.7% in 2019 alone largely due to the successful integration of Spectrum Brands' global battery and lighting segment.

Energizer Holdings Inc. (US industry-specific segment) - financial performance*

Year**	Revenue ($ million)	(% change)	Operating Income ($ million)	(% change)
2013-14	941.9	N/C	110.1	N/C
2014-15	752.2	-20.1	-0.3	N/C
2015-16	891.4	18.5	90.4	N/C
2016-17	957.7	7.4	149.1	64.9
2017-18	1,078.6	12.6	105.1	-29.5
2018-2019**	1,464.0	35.7	142.7	35.8

*Estimates; **Year-end September

SOURCE: ANNUAL REPORT AND IBISWORLD

Player Performance

EnerSys Inc.
Market Share: 9.1 %

EnerSys Inc. (EnerSys) is one of the world's largest manufacturers of industrial batteries. Founded in 1999, the company's products are distributed to more than 100 countries worldwide, with headquarters in Reading, PA and facilities in the Americas, Europe and Asia. The company's products and services are focused on two primary markets: motive power and reserve power. Motive power includes corruptible power supply, electronics, security, portable power, switchgear and utility and sports and leisure. Products include batteries, chargers, accessories and field service to provide a stored-energy system; however, only batteries are considered industry-specific. EnerSys generated $2.6 billion in total company revenue as of the company's latest fiscal year-end, March 2018.

During the five-year period, the company has made several acquisitions. In April 2016, it completed the acquisition of assets of The Enser Corporation, which manufacturers molten-salt thermal

Major Companies

Player Performance continued

batteries for electrics, guidance and other electronic systems. In 2017, the company received an ISO 9001:2015 certification from the International Organization for Standardization (ISO), which certifies that EnerSys maintains consistency in product manufacturing and exceeds customer expectations. Furthermore, the company received a $60.0 million contract to supply lithium-ion cells and batteries to multiple space agencies and OEMs worldwide. In May 2018, the company cited strong performance in the Americas, largely due to strong demand for the company's thin-plate pure lead batteries. These batteries are typically considered premium batteries; consequently, the company has recognized a continued growth opportunity in shifting to production of premium batteries.

Financial performance

Over the five years to 2019, EnerSys' revenue growth has been all over the map as a result of the aforementioned acquisitions in addition to input price volatility occurring during the former half of the five-year period. A sharp decline in industrial production among emerging markets in 2015 contributed to a severe downturn in company revenue in 2015 and 2016. In addition to severe revenue volatility, the company's operating income has also fluctuated due to volatile commodity prices. For example, the price of nonferrous metals declined as much as 13.1% in 2015 and grew by as much as 17.7% in 2017, ultimately preventing EnerSys from securing stable purchasing contracts. However, in 2017 and 2018, company revenue and margins improved as commodity prices stabilized and demand from emerging markets recovered. Overall, EnerSys' industry-specific revenue is expected to increase an annualized 3.1% to $1.2 billion over the five years to 2019.

EnerSys Inc. (US industry-specific segment) - financial performance*

Year	Revenue ($ million)	(% change)	Operating Income ($ million)	(% change)
2013-2014	1,031.0	N/C	70.8	N/C
2014-2015	894.8	-13.2	68.2	-3.7
2015-2016	827.2	-7.6	89.0	30.5
2016-2017	910.4	10.1	65.0	-27.0
2017-2018	1,122.6	23.3	81.8	25.8
2018-2019**	1,201.1	7.0	103.6	26.7

*Estimates; **Year-end March

SOURCE: ANNUAL REPORT AND IBISWORLD

Major Companies

Other Company Performance

Duracell Inc.
Market Share: 0.8 %
Industry Brand Names
Duralock

Originally founded in 1924, Duracell Inc. (Duracell) is among the oldest manufacturers of batteries in the United States. Headquartered in Bethel, CT, the company has recently been acquired by Berkshire Hathaway Inc. from consumer goods conglomerate, the Proctor and Gamble Company. The transaction was completed in February 2016 for an estimated $1.8 billion in assets. Following the acquisition, Duracell has closed two production facilities in Cleveland, TN and Lancaster, SC while expanding production output at the company's LaGrange, GA facility. Overall, IBISWorld expects Duracell to generate $103.6 million in industry-specific revenue in 2019.

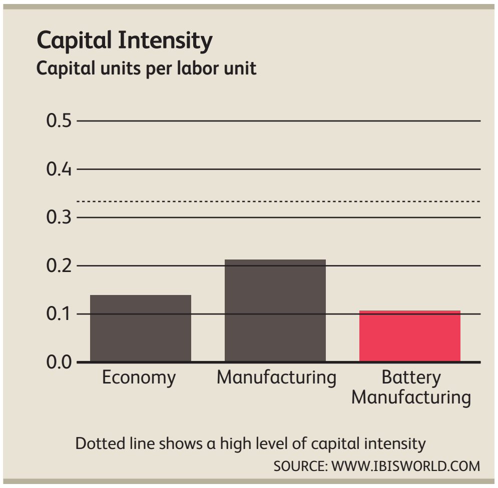
Operating Conditions

Capital Intensity | Technology & Systems | Revenue Volatility
Regulation & Policy | Industry Assistance

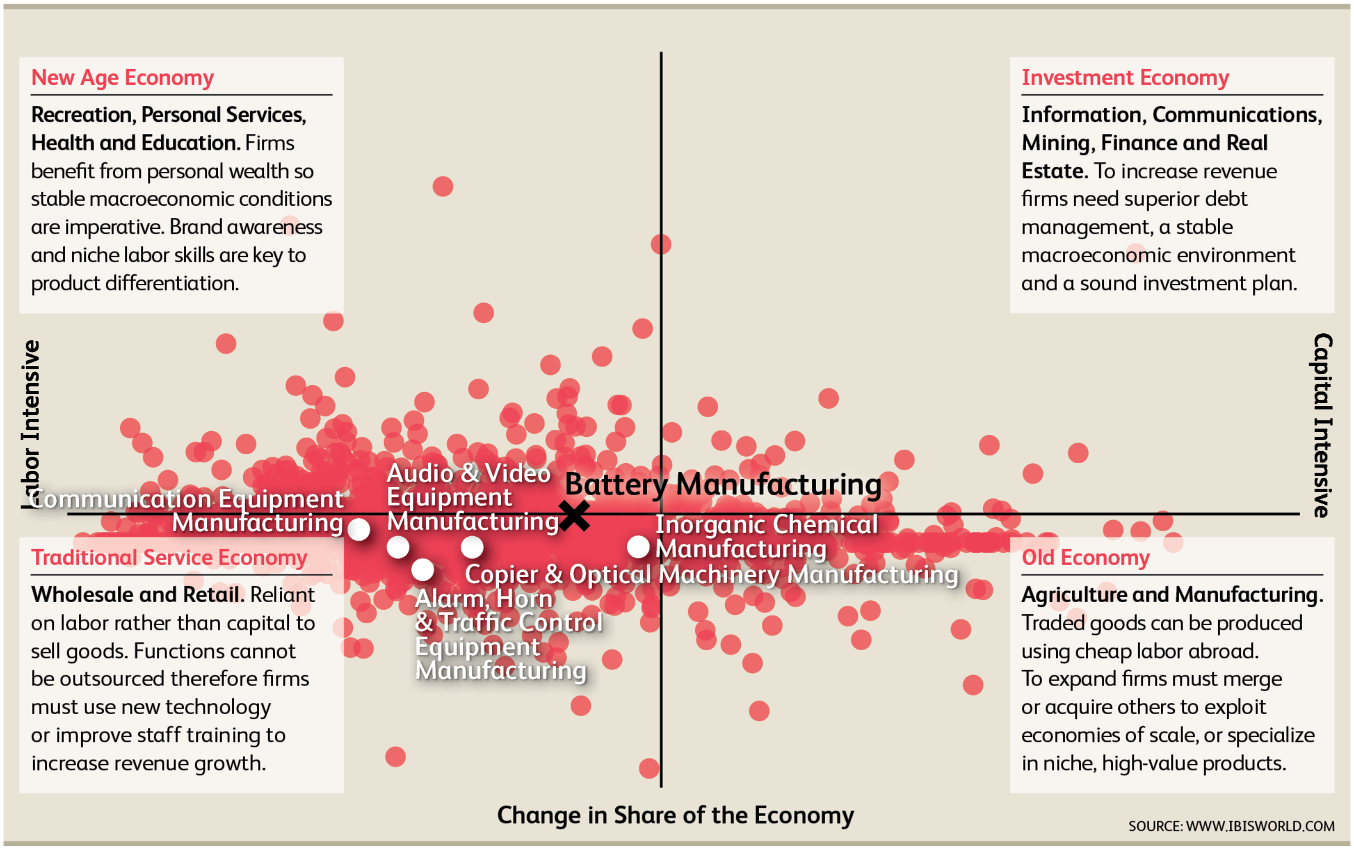
Capital Intensity

Level
The level of capital intensity is **Low**

The Battery Manufacturing industry exhibits a low level of capital intensity. In 2019, the industry is expected to invest $0.11 on capital for every dollar spent on labor. New product innovations require changes in the production processes and changes in the necessary machines to produce batteries. For example, Tesla Inc. and Panasonic Energy of North America have invested heavily in automated production processes in an effort to increase production output and efficiency. IBISWorld expects this trend toward automated battery manufacturing facilities to continue. Nevertheless, the industry also spends a significant amount on labor, due to the industry's significant research and development operations. Since researchers often need advanced degrees in chemistry and engineering, this pushes up the average industry wage, which is estimated to be $69,622 in 2019.



Tools of the Trade: Growth Strategies for Success



Operating Conditions

Technology and Systems

Level
The level of technology change is **High**

Research and development remains an integral component of Battery Manufacturing industry operations to remain competitive. Technological change within the industry is focused on developing batteries that have a longer running time, produce a higher voltage, reduce emissions, reduce recharge time, increase the number of recharges and increase safety.

Duracell Inc. (Duracell) has released a new technology that enables batteries to store energy longer than other batteries. The brand name for these batteries is Duralock. In fact, when left in storage, Duralock batteries last up to 10 years after the purchase date. Other battery manufacturers are expected to strive to attain similar results to remain competitive. Furthermore, researchers in Korea at the Ulsan National Institute of Science and Technology (UNIST) believed they have found a new technology that will enable lithium-ion batteries to charge up to 120 times faster than normal, although the technology has not been put into production yet. Additionally, researchers are also working on a new generation of lithium-air batteries, which will be capable of storing up to 10 times the amount of energy as today's commercial lithium-ion cells.

New materials have also increased the safety and efficiency of batteries. For example, replacement of cadmium in nickel-cadmium (NiCd) batteries with a metal hydride enables for batteries to provide more power as well as eliminating the use of heavy metals, making them safer and more environmentally friendly. According to Battery University, nickel-metal-hydride (NiMH) batteries provide improved energy (up to 40.0% greater than NiCd batteries) granting longer running times or reductions in battery sizes.

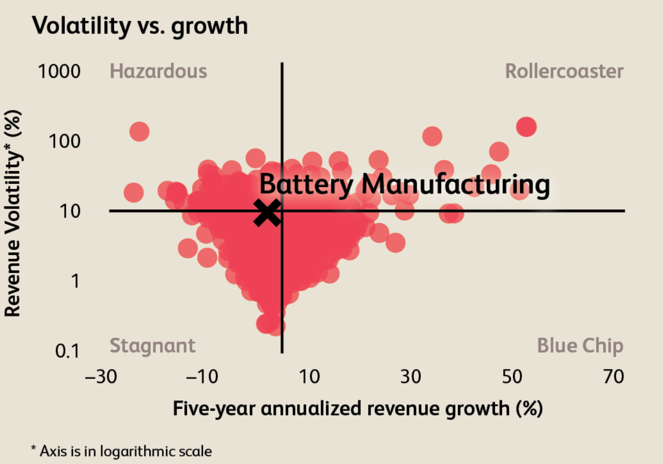
Revenue Volatility

Level
The level of volatility is **Medium**

Unstable downstream demand, rising imports and falling battery prices have contributed to moderate revenue volatility over the five years to 2019. Manufacturers in this industry supply batteries to many different downstream industries, exposing themselves to a variety of risks affecting these industries. Additionally, since industry operators sell to other manufacturing and industrial industries, commodity price fluctuations have the potential to affect industry performance.

A higher level of revenue volatility implies greater industry risk. Volatility can negatively affect long-term strategic decisions, such as the time frame for capital investment.

When a firm makes poor investment decisions it may face underutilized capacity if demand suddenly falls, or capacity constraints if it rises quickly.



SOURCE: WWW.IBISWORLD.COM

Operating Conditions

Revenue Volatility continued

For instance, the automotive sector, one of the industry's major markets, tends to be volatile due to its sensitivity to raw materials prices and consumer demand. Traditionally, the relatively constant source of demand from consumer electronics mitigated further declines in revenue from falling automotive demand.

Regulation and Policy

Level & Trend
The level of Regulation is **Heavy** and the trend is **Steady**

The Battery Manufacturing industry is subject to federal, state, local and foreign environmental laws and regulations. These regulations control the storage, handling, disposal, emission, transportation and discharge of hazardous substances, materials and waste products. The main regulations affecting the industry are environmental laws and quality standards. Manufacturers are required to meet EPA emission standards, ISO 9000, QS 9000 or equivalent quality standards and Occupational Safety and Health Administration (OSHA) standards. Battery manufacturers are also subject to standard environmental regulations such as the Clean Air Act. Exide Technologies failed to meet emissions standards set by the US Environmental Protection Agency as part of the clean air act during May 2014 and contended with a $37,500 fine per day for each violation.

OSHA standards

The Battery Manufacturing industry is a major user of lead. According to the US Geological Survey, 90% of the US lead consumption is for lead-based batteries in 2015. Lead is absorbed in the body by ingestion or inhalation thus battery plant workers are subject to lead toxicity. Consequently, workers regularly exposed to lead require regular blood testing. Currently, the Occupational Safety and Health Administration (OSHA) threshold for workers in battery plants is 50 micrograms of lead per deciliter of whole blood. An employee with a test result of 50 will be moved to a different job within the plant until blood lead levels fall. The OSHA together with Battery Council International (BCI), is working to reduce lead exposure in battery plant workers from the 50 micrograms threshold to 30 micrograms by December 31st, 2016.

IEC System of Conformity Assessment Schemes for Electrontechnical Equipment and Components IEC 60086-1:2015(E) is intended to standardize primary batteries with respect to dimensions, nomenclature, terminal configurations, markings, test methods, typical performance, safety and environmental aspects. As a primary battery classification tool, electrochemical systems are also standardized with respect to system letter, electrodes, electrolyte, nominal and maximum open circuit voltage. The object of this part of IEC 60086 is to benefit primary battery users, device designers and battery manufacturers by ensuring that batteries from different manufacturers are interchangeable according to standard form, fit and function.

Operating Conditions

Industry Assistance

Level & Trend
The level of Industry Assistance is **Medium** and the trend is **Increasing**

The federal stimulus benefited automakers and, consequently, producers of car batteries

All imported batteries to the United States are subjected to tariffs. Primary batteries are subject to a 2.7% tariff. Varieties include manganese dioxide batteries; mercuric oxide batteries; silver oxide batteries; lithium batteries and air-zinc batteries. Within the storage battery segment, tariffs vary depending on the material used to manufacture the product. For example: lead-acid storage batteries are subject to a 3.5% tariff; nickel-cadmium storage batteries are subject to a 2.5% tariff and nickel-iron storage batteries are subject to a 3.4% tariff. Other storage batteries that are used as the primary source of electrical power for electrically powered vehicles are subject to a 3.4% tariff.

Participants receive assistance from industry bodies, including the Battery Council International. In the automotive segment, high gasoline costs and growing regard to environmental degradation has led the US Department of Energy to assist manufacturers. Assistance has included funds to develop lithium-ion battery systems for plug-in hybrid-electric vehicles (PHEVs) and market research to validate the commercial feasibility of lithium-ion technology for mass market PHEVs. The assistance comes in the form of funding the United States Advanced Battery Consortium (US ABC), whose members are Chrysler LLC, Ford Motor Company and General Motors Company. During the five-year period, the consortium has provided a variety of contracts to assist with the development of battery technology. One of the more recent contracts was awarded in August 2015 when Saft America, a company involved in the design, development and manufacturing of batteries, received a $6.1 million contract to develop 12-volt stop-start battery technology for vehicles.

Key Statistics

Industry Data

	Revenue ($m)	Industry Value Added ($m)	Establish-ments	Enterprises	Employment	Exports ($m)	Imports ($m)	Wages ($m)	Domestic Demand	Electric power consumption ($ per ton)
2010	12,518.3	2,680.5	185	131	24,545	1,949.1	2,979.2	1,466.3	13,548.4	3,887.3
2011	13,300.8	2,374.5	195	141	25,818	2,320.0	3,359.6	1,536.6	14,340.4	3,883.6
2012	12,371.5	2,418.1	191	139	26,230	2,351.9	3,780.0	1,589.3	13,799.6	3,821.6
2013	11,553.0	2,450.4	200	146	25,740	2,814.3	3,995.3	1,595.5	12,734.0	3,869.0
2014	12,624.1	2,381.8	207	156	25,102	3,081.3	4,259.4	1,599.1	13,802.2	3,901.9
2015	12,557.1	2,491.5	208	155	26,069	3,301.5	4,301.8	1,712.9	13,557.4	3,901.9
2016	11,760.7	2,436.4	224	166	27,145	3,244.0	4,956.2	1,742.5	13,472.9	3,890.9
2017	12,748.9	2,682.6	240	178	28,971	3,372.4	6,140.3	2,019.7	15,516.8	3,821.6
2018	13,141.3	2,812.2	250	185	29,884	3,823.9	7,241.9	2,083.0	16,559.3	3,923.8
2019	13,257.7	2,844.3	256	190	30,324	3,911.8	7,529.7	2,111.2	16,875.6	3,901.9
2020	13,461.6	2,894.5	265	197	30,929	4,013.5	7,745.6	2,151.4	17,193.7	3,919.9
2021	13,611.3	2,935.6	272	203	31,481	4,176.1	7,997.3	2,186.9	17,432.5	3,932.7
2022	13,794.5	2,985.1	280	209	32,129	4,336.9	8,233.3	2,228.8	17,690.9	3,954.2
2023	13,995.7	3,038.0	289	216	32,812	4,503.8	8,562.6	2,273.2	18,054.5	3,979.2
2024	14,072.9	3,065.5	296	222	33,263	4,677.2	8,860.1	2,300.7	18,255.8	4,005.0
Sector Rank	**114/193**	**112/193**	**159/193**	**157/193**	**110/193**	**66/184**	**70/184**	**96/193**	**116/184**	**N/A**
Economy Rank	**457/694**	**500/694**	**652/694**	**643/694**	**524/694**	**75/216**	**74/216**	**462/694**	**127/216**	**N/A**

Annual Change

	Revenue (%)	Industry Value Added (%)	Establish-ments (%)	Enterprises (%)	Employment (%)	Exports (%)	Imports (%)	Wages (%)	Domestic Demand (%)	Electric power consumption (%)
2011	6.3	-11.4	5.4	7.6	5.2	19.0	12.8	4.8	5.8	-0.1
2012	-7.0	1.8	-2.1	-1.4	1.6	1.4	12.5	3.4	-3.8	-1.6
2013	-6.6	1.3	4.7	5.0	-1.9	19.7	5.7	0.4	-7.7	1.2
2014	9.3	-2.8	3.5	6.8	-2.5	9.5	6.6	0.2	8.4	0.9
2015	-0.5	4.6	0.5	-0.6	3.9	7.1	1.0	7.1	-1.8	0.0
2016	-6.3	-2.2	7.7	7.1	4.1	-1.7	15.2	1.7	-0.6	-0.3
2017	8.4	10.1	7.1	7.2	6.7	4.0	23.9	15.9	15.2	-1.8
2018	3.1	4.8	4.2	3.9	3.2	13.4	17.9	3.1	6.7	2.7
2019	0.9	1.1	2.4	2.7	1.5	2.3	4.0	1.4	1.9	-0.6
2020	1.5	1.8	3.5	3.7	2.0	2.6	2.9	1.9	1.9	0.5
2021	1.1	1.4	2.6	3.0	1.8	4.1	3.2	1.7	1.4	0.3
2022	1.3	1.7	2.9	3.0	2.1	3.9	3.0	1.9	1.5	0.5
2023	1.5	1.8	3.2	3.3	2.1	3.8	4.0	2.0	2.1	0.6
2024	0.6	0.9	2.4	2.8	1.4	3.9	3.5	1.2	1.1	0.6
Sector Rank	**114/193**	**106/193**	**27/193**	**20/193**	**62/193**	**96/184**	**29/184**	**84/193**	**59/184**	**N/A**
Economy Rank	**479/694**	**454/694**	**153/694**	**115/694**	**329/694**	**103/216**	**37/216**	**392/694**	**64/216**	**N/A**

Key Ratios

	IVA/Revenue (%)	Imports/ Demand (%)	Exports/ Revenue (%)	Revenue per Employee ($'000)	Wages/Revenue (%)	Employees per Est.	Average Wage ($)	Share of the Economy (%)
2010	21.41	21.99	15.57	510.01	11.71	132.68	59,739.25	0.02
2011	17.85	23.43	17.44	515.18	11.55	132.40	59,516.62	0.01
2012	19.55	27.39	19.01	471.65	12.85	137.33	60,590.93	0.01
2013	21.21	31.38	24.36	448.83	13.81	128.70	61,985.24	0.01
2014	18.87	30.86	24.41	502.91	12.67	121.27	63,704.09	0.01
2015	19.84	31.73	26.29	481.69	13.64	125.33	65,706.39	0.01
2016	20.72	36.79	27.58	433.25	14.82	121.18	64,192.30	0.01
2017	21.04	39.57	26.45	440.06	15.84	120.71	69,714.54	0.01
2018	21.40	43.73	29.10	439.74	15.85	119.54	69,702.85	0.02
2019	21.45	44.62	29.51	437.20	15.92	118.45	69,621.42	0.01
2020	21.50	45.05	29.81	435.24	15.98	116.71	69,559.31	0.01
2021	21.57	45.88	30.68	432.37	16.07	115.74	69,467.30	0.01
2022	21.64	46.54	31.44	429.35	16.16	114.75	69,370.35	0.01
2023	21.71	47.43	32.18	426.54	16.24	113.54	69,279.53	0.01
2024	21.78	48.53	33.24	423.08	16.35	112.38	69,166.94	0.01
Sector Rank	**110/193**	**48/184**	**42/184**	**87/193**	**81/193**	**26/193**	**44/193**	**112/193**
Economy Rank	**475/694**	**54/216**	**51/216**	**237/694**	**382/694**	**44/694**	**170/694**	**500/694**

Figures are in inflation-adjusted 2019 dollars. Rank refers to 2019 data.

SOURCE: WWW.IBISWORLD.COM

Industry Financial Ratios

	Apr 2014 - Mar 2015	Apr 2015 - Mar 2016	Apr 2016 - Mar 2017	Apr 2017 - Mar 2018	Apr 2017 - Mar 2018 by company revenue: Small (<$10m)	Medium ($10-50m)	Large (>$50m)
Liquidity Ratios							
Current Ratio	1.7	2.4	2.4	2.5	n/a	2.5	n/a
Quick Ratio	1.0	1.1	0.9	1.0	n/a	0.9	n/a
Sales / Receivables (Trade Receivables Turnover)	7.7	8.9	7.4	7.1	n/a	7.2	n/a
Days' Receivables	47.4	41.0	49.3	51.4	n/a	50.7	n/a
Cost of Sales / Inventory (Inventory Turnover)	5.2	4.7	5.2	4.4	n/a	4.1	n/a
Days' Inventory	70.2	77.7	70.2	83.0	n/a	89.0	n/a
Cost of Sales / Payables (Payables Turnover)	9.3	11.5	9.8	10.2	n/a	11.7	n/a
Days' Payables	39.2	31.7	37.2	35.8	n/a	31.2	n/a
Sales / Working Capital	8.0	4.3	6.3	4.2	n/a	7.0	n/a
Coverage Ratios							
Earnings Before Interest & Taxes (EBIT) / Interest	6.0	9.1	2.9	4.3	n/a	n/a	n/a
Net Profit + Dep., Depletion, Amort. / Current Maturities LT Debt	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Leverage Ratios							
Fixed Assets / Net Worth	0.3	0.3	0.4	0.3	n/a	0.4	n/a
Debt / Net Worth	2.0	0.7	1.1	1.3	n/a	2.5	n/a
Tangible Net Worth	33.6	46.8	39.0	35.7	n/a	31.3	n/a
Operating Ratios							
Profit before Taxes / Net Worth, %	25.3	14.6	15.3	10.7	n/a	n/a	n/a
Profit before Taxes / Total Assets, %	7.6	4.0	4.8	5.9	n/a	5.8	n/a
Sales / Net Fixed Assets	16.9	9.1	23.2	28.3	n/a	17.7	n/a
Sales / Total Assets (Asset Turnover)	2.0	1.7	1.6	1.9	n/a	1.6	n/a
Cash Flow & Debt Service Ratios (% of sales)							
Cash from Trading	30.4	n/a	30.8	n/a	n/a	n/a	n/a
Cash after Operations	6.6	n/a	4.2	n/a	n/a	n/a	n/a
Net Cash after Operations	6.0	n/a	2.9	n/a	n/a	n/a	n/a
Cash after Debt Amortization	2.0	n/a	-0.4	n/a	n/a	n/a	n/a
Debt Service P&I Coverage	3.3	n/a	1.4	n/a	n/a	n/a	n/a
Interest Coverage (Operating Cash)	14.5	n/a	2.5	n/a	n/a	n/a	n/a
Assets, %							
Cash & Equivalents	11.8	9.9	15.4	13.5	n/a	9.7	n/a
Trade Receivables (net)	30.0	22.2	24.6	24.9	n/a	18.7	n/a
Inventory	25.9	29.0	29.5	33.2	n/a	35.1	n/a
All Other Current Assets	2.5	6.5	3.4	5.8	n/a	3.3	n/a
Total Current Assets	70.2	67.6	72.9	77.4	n/a	66.8	n/a
Fixed Assets (net)	17.2	21.0	13.4	12.7	n/a	18.6	n/a
Intangibles (net)	4.3	8.3	11.5	7.2	n/a	13.3	n/a
All Other Non-Current Assets	8.3	3.0	2.2	2.7	n/a	1.3	n/a
Total Assets	100.0	100.0	100.0	100.0	n/a	100.0	n/a
Total Assets ($m)	1,464.8	1,269.1	932.7	422.1	17.8	181.2	223.1
Liabilities, %							
Notes Payable-Short Term	8.4	8.5	8.8	10.7	n/a	6.1	n/a
Current Maturities L/T/D	2.0	0.4	0.9	2.5	n/a	4.9	n/a
Trade Payables	17.5	12.9	16.1	17.9	n/a	17.0	n/a
Income Taxes Payable	n/a	0.1	0.1	0.1	n/a	0.1	n/a
All Other Current Liabilities	14.1	10.7	8.0	9.1	n/a	11.0	n/a
Total Current Liabilities	42.1	32.6	33.9	40.2	n/a	39.1	n/a
Long Term Debt	17.1	8.8	12.2	7.8	n/a	13.1	n/a
Deferred Taxes	0.4	1.3	0.5	0.2	n/a	0.3	n/a
All Other Non-Current Liabilities	2.5	2.2	2.9	8.9	n/a	3.0	n/a
Net Worth	37.9	55.1	50.5	42.9	n/a	44.6	n/a
Total Liabilities & Net Worth ($m)	1,464.8	1,269.1	932.7	422.1	17.8	181.2	223.1
Maximum Number of Statements Used	46	28	31	24	9	11	4

Source: RMA Annual Statement Studies, rmahq.org. RMA data for all industries is derived directly from more than 260,000 statements of member financial institutions' borrowers and prospects.

Note: For a full description of the ratios refer to the Key Statistics chapter online.

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Jargon & Glossary

Industry Jargon

BATTERY Electrochemical device used to store energy. In common usage, the term "battery" is also applied to a single cell, such as an AA battery.

DRY CELL Primary cell in which the electrolyte is absorbed in a porous medium or is otherwise restrained from flowing.

NONFERROUS METALS Metals other than iron and steel, including zinc, lead, copper and gold.

ORIGINAL EQUIPMENT MANUFACTURERS (OEM) Refers to the company that originally manufactured a product. When referring to automotive parts, OEM designates a replacement part made by the manufacturer of the original part.

PRIMARY BATTERY Batteries that cannot be recharged and are therefore disposable once depleted.

PRIMARY CELL Cell designed to produce electric current through an electrochemical reaction that is not efficiently reversible.

RECHARGEABLE Capable of being recharged. Refers to secondary cells or batteries.

STORAGE BATTERY Rechargeable batteries.

IBISWorld Glossary

BARRIERS TO ENTRY High barriers to entry mean that new companies struggle to enter an industry, while low barriers mean it is easy for new companies to enter an industry.

CAPITAL INTENSITY Compares the amount of money spent on capital (plant, machinery and equipment) with that spent on labor. IBISWorld uses the ratio of depreciation to wages as a proxy for capital intensity. High capital intensity is more than $0.333 of capital to $1 of labor; medium is $0.125 to $0.333 of capital to $1 of labor; low is less than $0.125 of capital for every $1 of labor.

CONSTANT PRICES The dollar figures in the Key Statistics table, including forecasts, are adjusted for inflation using the current year (i.e. year published) as the base year. This removes the impact of changes in the purchasing power of the dollar, leaving only the "real" growth or decline in industry metrics. The inflation adjustments in IBISWorld's reports are made using the US Bureau of Economic Analysis' implicit GDP price deflator.

DOMESTIC DEMAND Spending on industry goods and services within the United States, regardless of their country of origin. It is derived by adding imports to industry revenue, and then subtracting exports.

EMPLOYMENT The number of permanent, part-time, temporary and seasonal employees, working proprietors, partners, managers and executives within the industry.

ENTERPRISE A division that is separately managed and keeps management accounts. Each enterprise consists of one or more establishments that are under common ownership or control.

ESTABLISHMENT The smallest type of accounting unit within an enterprise, an establishment is a single physical location where business is conducted or where services or industrial operations are performed. Multiple establishments under common control make up an enterprise.

EXPORTS Total value of industry goods and services sold by US companies to customers abroad.

IMPORTS Total value of industry goods and services brought in from foreign countries to be sold in the United States.

INDUSTRY CONCENTRATION An indicator of the dominance of the top four players in an industry. Concentration is considered high if the top players account for more than 70% of industry revenue. Medium is 40% to 70% of industry revenue. Low is less than 40%.

INDUSTRY REVENUE The total sales of industry goods and services (exclusive of excise and sales tax); subsidies on production; all other operating income from outside the firm (such as commission income, repair and service income, and rent, leasing and hiring income); and capital work done by rental or lease. Receipts from interest royalties, dividends and the sale of fixed tangible assets are excluded.

INDUSTRY VALUE ADDED (IVA) The market value of goods and services produced by the industry minus the cost of goods and services used in production. IVA is also described as the industry's contribution to GDP, or profit plus wages and depreciation.

INTERNATIONAL TRADE The level of international trade is determined by ratios of exports to revenue and imports to domestic demand. For exports/revenue: low is less than 5%, medium is 5% to 20%, and high is more than 20%. Imports/domestic demand: low is less than 5%, medium is 5% to 35%, and high is more than 35%.

LIFE CYCLE All industries go through periods of growth, maturity and decline. IBISWorld determines an industry's life cycle by considering its growth rate (measured by IVA) compared with GDP; the growth rate of the number of establishments; the amount of change the industry's products are undergoing; the rate of technological change; and the level of customer acceptance of industry products and services.

Jargon & Glossary

IBISWorld Glossary continued

NONEMPLOYING ESTABLISHMENT Businesses with no paid employment or payroll, also known as nonemployers. These are mostly set up by self-employed individuals.

PROFIT IBISWorld uses earnings before interest and tax (EBIT) as an indicator of a company's profitability. It is calculated as revenue minus expenses, excluding interest and tax.

VOLATILITY The level of volatility is determined by averaging the absolute change in revenue in each of the past five years. Volatility levels: very high is more than ±20%; high volatility is ±10% to ±20%; moderate volatility is ±3% to ±10%; and low volatility is less than ±3%.

WAGES The gross total wages and salaries of all employees in the industry. The cost of benefits is also included in this figure.