

Economic Contribution of the California Lead Battery Industry

October 2019

Prepared for:

Battery Council International

330 N. Wabash Ave., Suite 2000, Chicago, IL 60611



Prepared by:

EDR Group, an EBP Company

155 Federal Street, Suite 600, Boston, MA 02110



TABLE OF CONTENTS

Study Overview	1
Lead Battery Industry Overview	1
Lead Battery Demand Growth & Recycling.....	2
Lead Battery Research & Development.....	6
Lead Batteries & the Economy	8
Types of Economic Impact	8
Direct Economic Impact.....	8
Lead Battery Wages & Occupations.....	9
Green Jobs	11
Total Economic Contribution	12
Conclusion	15
About EDR Group, an EBP Company	16
About Battery Council International	16
Appendix	17
Methodology	17
Definition of Terms	17

Executive Summary

California is home to a significant amount of lead battery manufacturing and recycling activity. This activity generates economic impacts that spread throughout the statewide economy, affecting a variety of industry sectors.

Lead batteries are essential to everyday life, and with a recycling rate exceeding 99%ⁱ, they are the most recycled consumer product in the U.S.ⁱⁱ A new lead battery consists of over 80% recycled material,ⁱⁱⁱ and nearly 70% of its lead comes from recycling.^{iv} Lead battery manufacturers and recyclers contribute to the economy in the following ways:

1. When companies in the lead battery manufacturing and recycling industry employ workers and generate business income. These represent **direct impacts**.
2. When companies in the lead battery manufacturing and recycling industry purchase goods and services from other companies. These represent **supplier impacts**.
3. When workers at lead battery manufacturing and recycling companies, as well as workers at supplier companies, spend their after-tax income on consumer goods. These represent **worker spending impacts**.
4. Companies in the lead battery industry also employ workers in **transportation and distribution**. These activities further add to the industry's impact.
5. Companies in the lead battery industry innovate through ongoing **research and development**. These R&D activities contribute to the industry's future growth and productivity.

Workers in the California lead battery industry hold a variety of occupations, many of which are accessible to those who have only a high school diploma. The industry directly employs approximately 1,072 workers and spends \$195.9 million annually on payroll. In addition to the workers that California's lead battery industry directly employs, it supports 1,154 supplier jobs and 830 jobs from worker spending in different industries. **Together, these impacts total 3,056 jobs plus an additional 77 R&D jobs.** Beyond jobs, the California lead battery industry annually supports

- \$195.9 million in labor income,
- \$332.9 million in gross state product (GSP),
- \$998.6 million in output or overall economic impact, and
- \$92.9 million in government revenue.

These impacts represent the lead battery industry's contribution to the California statewide economy.^v

ⁱ *National Recycling Rate Study*, Battery Council International, 2017.

ⁱⁱ *Advancing Sustainable Materials Management: 2015 Fact Sheet*, Environmental Protection Agency, July 2018.

ⁱⁱⁱ "Environmental Impact and Life Cycle Assessment of Lead Battery and Architectural Sheet Production," *The International Journal of Life Cycle Assessment*, 2016.

^{iv} Data provided by Principal Analyst, Lead Markets at Wood Mackenzie, 2019.

^v Gross State Product (GSP) represents the total value of goods produced by the California lead battery industry. Output represents total sales made by the industry. GSP is smaller than output because it excludes the cost of supplies. Labor income is a subset of GSP and GSP is a subset of output. Therefore, these figures should not be combined.

STUDY OVERVIEW

The following study measures the statewide economic contribution of the California lead battery industry in calendar year 2018. The analysis was conducted using an economic impact model called IMPLAN. A survey was used to collect data including annual employment and payroll information from six Battery Council International (BCI) member companies supporting direct jobs in California.¹ Survey results were added across companies to yield activity that was put into a California IMPLAN model. Impacts are presented in terms of jobs, labor income, gross state product, output, and tax revenue.

LEAD BATTERY INDUSTRY OVERVIEW

Lead batteries are among the world's safest and most reliable sources of energy. Whether starting a car, storing power from a solar panel, or providing emergency backup power, lead batteries provide energy for the daily activities of billions of people around the globe. Indeed, over one billion vehicles rely on lead batteries, including most hybrids and electric vehicles, and over 70% of global rechargeable energy storage needs are met by this technology.²

Lead batteries are also among the most environmentally sustainable consumer products, with a recycling and reuse rate exceeding 99%.³ By comparison, the recycling rate for aluminum cans is 54.9%.⁴ The average new lead battery is comprised of more than 80% recycled material.⁵ The lead battery industry uses a circular economy model, which means nearly all the materials used to produce batteries are either reused by the industry or recycled into other products (Figure 1).⁶ Lead used in batteries can be infinitely recycled with no loss of performance—a quality that is unique among consumer products. This, coupled with high recycling rates, reduces the need to mine for virgin materials.

Advanced lead batteries also facilitate new start-stop vehicle technology, which allow cars to temporarily stop their engines while idling. Start-stop technology utilizing lead batteries is eliminating 4.5 million tons of greenhouse gas emissions annually in the U.S.⁷

¹ All individual company data was kept confidential and company identities were not revealed as part of this study.

² *The Rechargeable Battery Market and Main Trends 2018-2030*, Avicenne Energy, May 2019.

³ *National Recycling Rate Study*, Battery Council International, 2017.

⁴ *Advancing Sustainable Materials Management: 2015 Fact Sheet*, Environmental Protection Agency, July 2018.

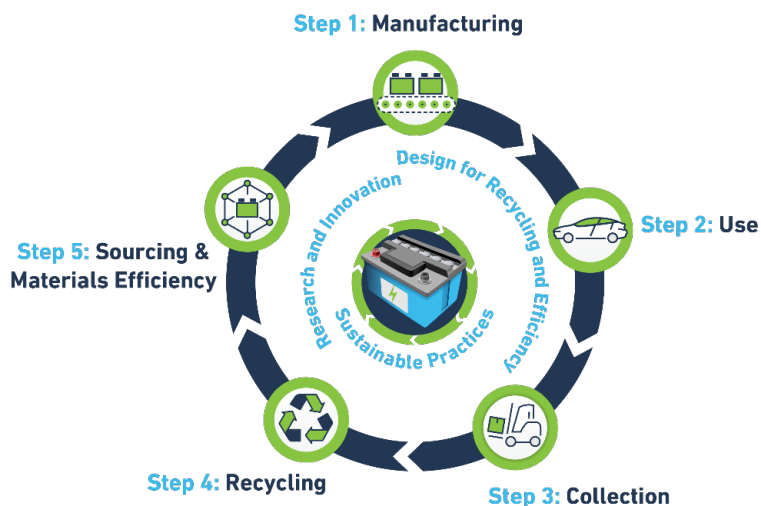
⁵ "Environmental Impact and Life Cycle Assessment of Lead Battery and Architectural Sheet Production," *The International Journal of Life Cycle Assessment*, 2016.

⁶ "The Circular Economy of Lead Batteries," April 18, 2019, Essential Energy Everyday, <https://essentialenergyeveryday.com/wp-content/uploads/2019/04/Circular-Economy-Brief.pdf>.

⁷ Consortium for Battery Innovation, 2019.

Figure 1. The lead battery industry, with its established circular infrastructure, is a model for other battery chemistries in how to responsibly source, use, reuse, and manage materials.

CIRCULAR ECONOMY OF LEAD BATTERIES



Source: "The Circular Economy of Lead Batteries," Essential Energy Everyday, April 2019.

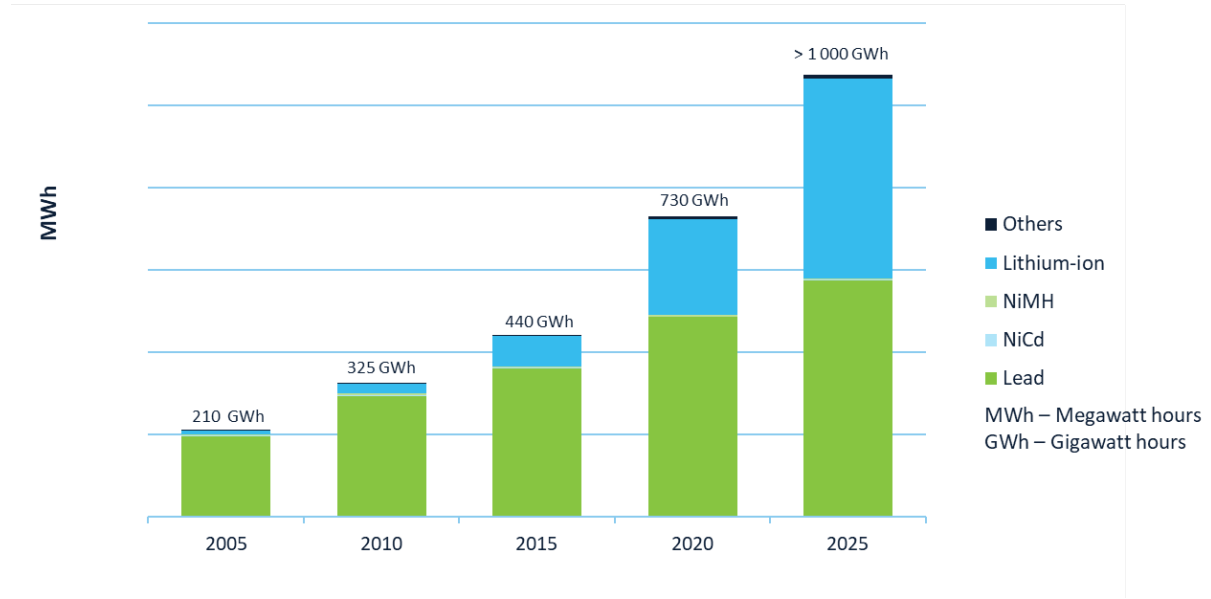
Lead Battery Demand Growth & Recycling

Rechargeable batteries are needed now more than ever to meet the energy demands of the growing population and need for batteries in new concepts of electric mobility and stationary energy storage (Figure 2). Unfortunately, many rechargeable batteries are not recycled profitably (and therefore hardly recycled at all) because the price of recycled materials is higher than the price of virgin materials. The exception is lead batteries. Lead battery manufacturing is the most environmentally sustainable of all battery technologies. In addition, at a rate of 99%, lead batteries are the most recycled consumer product in the U.S. (Figure 3).

The flowchart in Figure 4 illustrates how lead batteries are recycled and how their components are used to manufacture new batteries. This effective waste-reduction process is sometimes referred to as "cradle-to-cradle" production or a "closed-loop" industry. This model also supports domestic jobs and domestic supply of recycled materials to produce new lead batteries as demand increases.

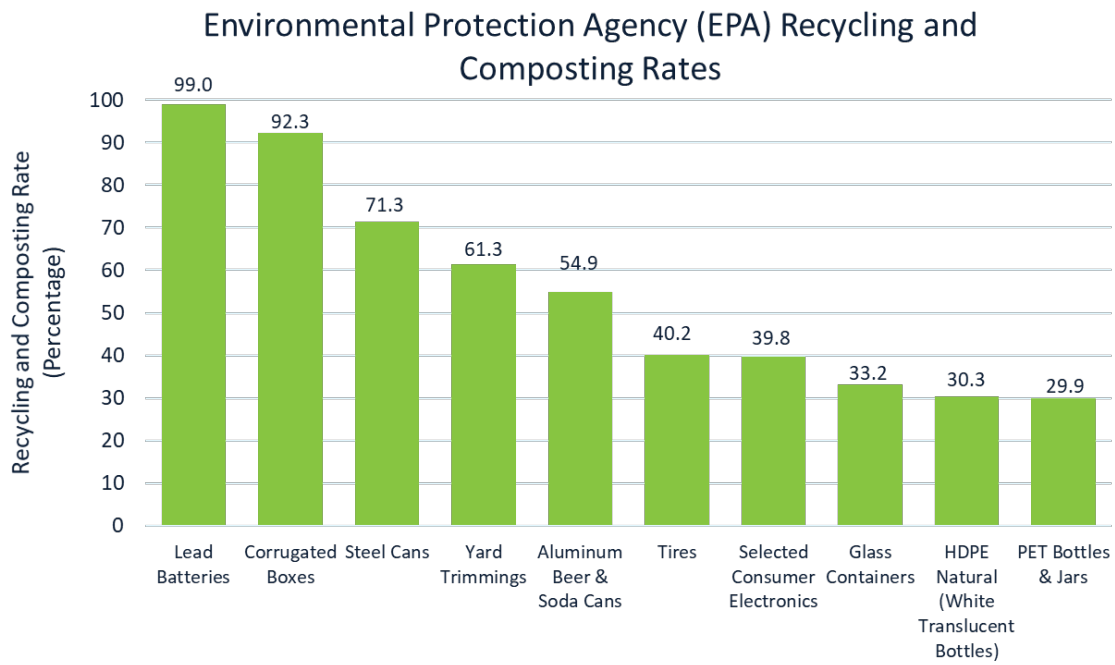
Figure 2. Rechargeable battery market projections show lead battery demand increasing. Trends driving battery market growth are the increasing energy demands of a growing population, city growth, and the growing demand for batteries from new concepts of mobility and energy (e.g., electric mobility, renewable energy storage).

Rechargeable Battery Market Worldwide 2000-2025



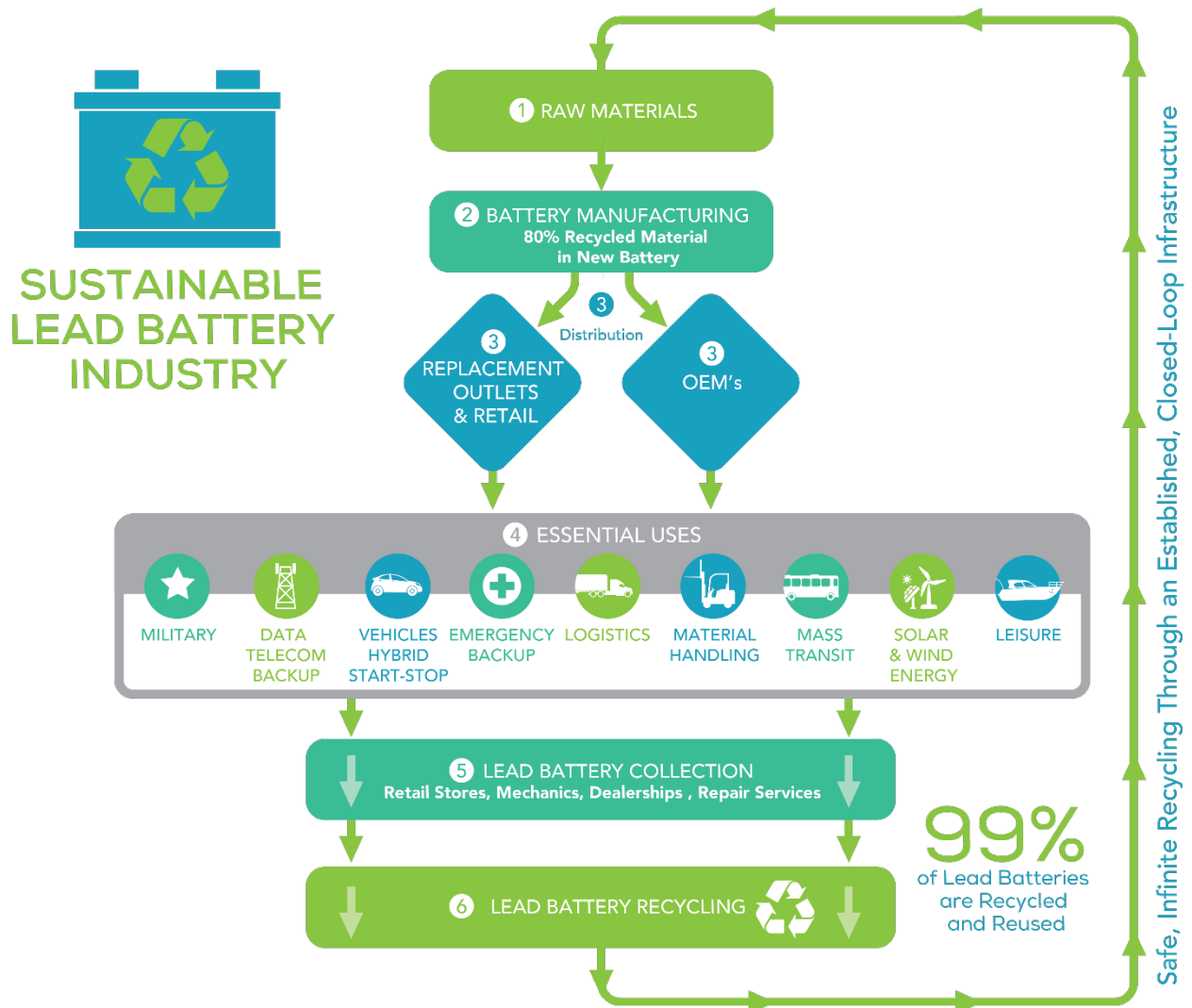
Source: *The Rechargeable Battery Market and Main Trends 2017-2025*, Avicenne Energy, Sept. 2018.

Figure 3. The Environmental Protection Agency (EPA) ranks lead batteries as the most recycled consumer product in the United States.



Source: *Advancing Sustainable Materials Management: 2015 Fact Sheet*, Environmental Protection Agency, July 2018.

Figure 4. An established, nationwide recycling infrastructure makes lead battery manufacturing the most environmentally sustainable of all battery technologies.



Source: Battery Council International, 2019.

Lead Battery Research & Development

Supporting new technologies and applications for lead batteries requires a commitment to constant innovation. In 2018 alone, the California lead battery industry invested \$17 million in research and development to continue meeting the rapidly changing needs within transportation, renewable energy, communications, and many other sectors. Additional advancements are expected from notable collaborations between public and private entities. Major lead battery manufacturers and suppliers are currently partnering with the U.S. Department of Energy’s Argonne National Laboratory and Missouri University of Science and Technology to research—and further advance—lead battery performance and energy storage applications.

Opportunities in Green Energy & Transportation

To date, innovation in lead battery production has significantly improved the lifespan of batteries and their ability to store energy. Lead batteries are a solution for renewable energy storage because of their long lifespan, ability to withstand extreme temperatures, and support of frequency regulation and load leveling. These features enable companies to store excess energy generated by wind turbines and solar panels when demand is low, and for long periods of time. Lead batteries are more affordable than comparable energy storage solutions, both up front and during decommissioning.

Start-stop technology utilizing advanced lead batteries is eliminating 4.5 million tons of greenhouse gas emissions annually in the U.S.⁸ Lead batteries are also enabling growth in electric vehicles (EVs) by providing critical safety and security functions. If an EV’s primary battery fails, the auxiliary lead battery ensures vital functions like braking and steering. With the support of the U.S. Department of Energy, lead batteries could soon support electric vehicles by storing energy—and managing electricity demand—at charging stations.⁹ This could accelerate the roll-out of EVs across California and the U.S.

Preparing to Fulfill Future Needs

A key opportunity for lead battery manufacturers is to store more energy in each battery, while still allowing users to extract power on-demand as efficiently as possible. Companies are exploring bipolar battery construction processes that can make lead batteries lighter, cheaper, faster-charging, and longer-lasting. Beyond developing improved batteries, manufacturers and recyclers are also working to make their processes more efficient. To further advance lead batteries in the marketplace, lead battery manufacturers and recyclers are members of the Consortium for Battery Innovation (CBI). CBI is the only global pre-competitive research organization that promotes innovation in lead batteries for energy storage, motive, and automotive applications. CBI has created a market-driven research “roadmap” based on a detailed analysis of market trends and future technical requirements of end users.

⁸ Consortium for Battery Innovation, 2019.

⁹ “Lead Batteries poised to support electric vehicle charging stations,” June 13, 2019, Consortium for Battery Innovation, <https://batteryinnovation.org/lead-batteries-poised-to-support-electric-vehicle-charging-stations>.

Finally, research and development supports long-term job creation and other economic impacts. When companies advance their products and production processes by adopting new technologies, they become more efficient and generate more sales, in turn allowing them to hire additional workers.

LEAD BATTERIES & THE ECONOMY

Types of Economic Impact

The lead battery industry contributes to California’s economy by generating jobs, income, GSP, and output (business sales) in five separate ways:

- **Direct impacts:** When companies in the lead battery industry employ workers and generate business income.
- **Supplier impacts:** When companies in the lead battery industry purchase goods and services from other manufacturers and suppliers (e.g., equipment, parts, materials, utilities).
- **Worker spending impacts:** When workers at companies in the lead battery industry and workers at supplier companies spend their after-tax income on consumer goods (e.g., food, housing).
- **Transportation and distribution:** Companies in the lead battery industry also employ workers in transportation and distribution. These activities further add to the industry’s impact.
- **Research and development:** Companies in the lead battery industry innovate through ongoing research and development. These R&D activities contribute to the industry’s future growth and productivity.

Direct Economic Impact

BCI’s members represent almost complete coverage of the California lead battery industry. In 2018, the industry paid \$58 million in wages to 1,072 employees (Table 1). In addition, companies spent \$17 million on research and development. This activity supported an additional 77 workers.

Table 1. The lead battery industry provides over 1,000 direct jobs in California.

Direct Jobs & Payroll at California Companies in the Lead Battery Industry in 2018

	Employment	Payroll
Lead Battery Manufacturing	767	\$33.4 million
Lead Battery Recycling	265	\$21.6 million
Transportation & Distribution	40	\$3.0 million
Total	1,072	\$58.0 million

	Employment	Spending
Research & Development	77	\$17.0 million

Sources: BCI company survey and IMPLAN. R&D includes \$14.5 million in spending that occurs at a research-only company not involved in manufacturing or recycling.

Lead Battery Wages & Occupations

The California lead battery industry pays high wages relative to other industry sectors. Average payroll-per-worker among lead battery manufacturing and recycling companies is \$54,100. This is higher than in construction and maintenance, retail and wholesale trade, and agriculture (Table 2).

Table 2. Payroll-per-worker in the California lead battery industry is higher than in several other private industry sectors.

Payroll-per-Worker in the California Lead Battery Industry & Other Sectors

Industry	Payroll-per-Worker (2018\$)
Professional Services	\$64,500
Lead Battery Manufacturing, Recycling & Transportation	\$54,100
Construction & Maintenance	\$51,000
Retail & Wholesale Trade	\$49,100
Agriculture	\$25,000

Sources: BCI company survey for bolded industry and IMPLAN for non-bolded industries (inflated to 2018 dollars).

Direct jobs in the lead battery industry are filled by workers in a variety of occupations (Table 3). Production occupations account for more than half of all jobs in the lead battery industry while high-skilled engineers, administrators, and managers account for another quarter.

Table 3. Workers in the lead battery industry are employed in a variety of occupations.

Occupations Included in the Lead Battery Industry

Occupation Category	Percent of Industry Workers
Production occupations	52.5%
Architecture and engineering occupations	10.0%
Office and administrative support occupations	9.5%
Management occupations	8.1%
Transportation and material moving occupations	4.7%
Business and financial occupations	4.2%
Installation, maintenance, and repair occupations	3.8%
Sales and related occupations	3.3%
Computer and mathematical occupations	2.1%
All other occupations	1.7%

Note: Percentages do not sum to 100 due to rounding.

Source: United States Bureau of Labor Statistics, 2018. Data is for NAICS 335900: Other electrical equipment and component manufacturing, which includes battery manufacturing.

Green Jobs

Some of the most common occupations in the lead battery industry are also occupations that comprise the greatest number of green jobs (Table 4). Green jobs are considered those that are involved in the production of goods or services that provide an environmental benefit, such as reducing pollution or natural resource depletion.¹⁰ There are numerous jobs in the lead battery industry that are considered green jobs. This is because the industry generates an environmental benefit by diverting materials from landfills and re-using materials in a circular economy model.

Table 4. Many of the top occupations in the lead battery industry are also occupations that have a high share of green jobs compared with other sectors of the economy.

Occupations with Significant Numbers of Green Jobs

Occupation Category	Percent of Industry Workers
Transportation and material moving occupations	19.3%
Production occupations	15.9%
Office and administrative support occupations	14.1%
Installation, maintenance, and repair occupations	6.2%
Business and financial occupations	5.8%
Management occupations	5.7%
Architecture and engineering occupations	5.7%

Source: Brookings Institution, 2011.

¹⁰ Brookings Institution, 2011, https://www.brookings.edu/wp-content/uploads/2016/06/0713_clean_economy_appendix.pdf.

Total Economic Contribution

California’s lead battery industry generated the following statewide job impacts in calendar year 2018:

- **Directly employed approximately 1,072 workers in manufacturing, recycling, and transportation, plus an additional 77 R&D jobs.**
- **Supported an additional 1,154 supplier jobs.** Supplier impacts (indirect impacts) result from companies in the lead battery industry spending money on goods and services.
- **Supported an additional 830 jobs from worker spending.** Worker spending impacts (induced impacts) result from workers at companies in the lead battery industry and their suppliers spending their wages throughout the California economy.

Together these impacts total 3,056 jobs statewide plus an additional 77 R&D jobs. In addition to its job impact, the California lead battery industry supported approximately

- \$195.9 million in labor income (includes wages and benefits),
- \$332.9 million in gross state product (GSP), and
- \$998.6 million in output or overall economic impact.

These impacts represent the industry’s contribution to the California economy in 2018 (Table 5).¹¹

Table 5. The California lead battery industry supports over 3,000 jobs and generates nearly a billion dollars in economic impact.

Economic Impacts of the California Lead Battery Industry in 2018

	Jobs	Labor Income	GSP	Output
Direct Impacts	1,072	\$56.6 million	\$97.5 million	\$589.8 million
Indirect Impacts (Suppliers)	1,154	\$90.9 million	\$148.0 million	\$267.2 million
Induced Impacts (Worker Spending)	830	\$48.3 million	\$87.4 million	\$141.6 million
Total	3,056	\$195.9 million	\$332.9 million	\$998.6 million

Note: The Labor Income total does not equal the exact sum of individual rows due to rounding.

Sources: Analysis by EDR Group based on industry survey and IMPLAN economic model for California.

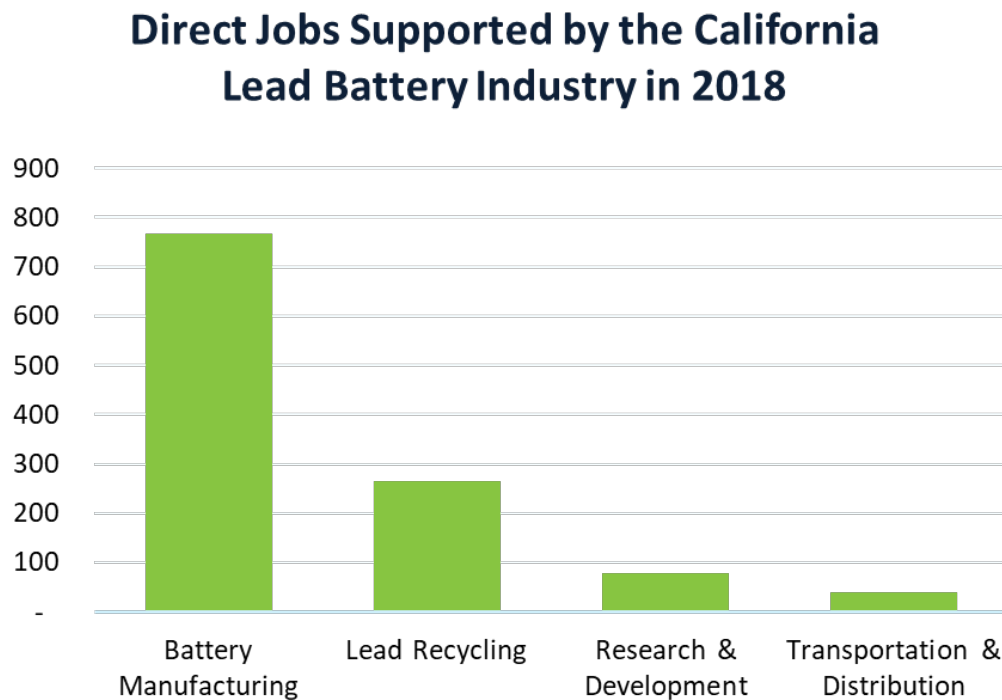
Note: Because lead battery manufacturers use recycled lead, some recycling companies support manufacturers within the same industry. The rest support other industries. The supplier impact from battery manufacturing reflects this fact by not counting jobs twice.

¹¹ Gross State Product (GSP) represents the total value of goods produced by the California lead battery industry. Output represents total sales made by the industry. GSP is smaller than output because it excludes payroll, profits, and the cost of supplies. Labor income is a subset of GSP and GSP is a subset of output. Therefore, these figures should not be combined.

Job Impacts by Industry

Companies in the California lead battery industry support direct jobs in four areas: battery manufacturing, lead recycling, research and development, and transportation and distribution. Direct jobs are those that exist at actual companies in the lead battery industry. These include 767 jobs in manufacturing, 265 jobs in recycling, 77 in research and development, and 40 jobs in transportation and distribution (Figure 2).

Figure 2. California’s lead battery industry supports over 3,000 direct jobs across four areas.



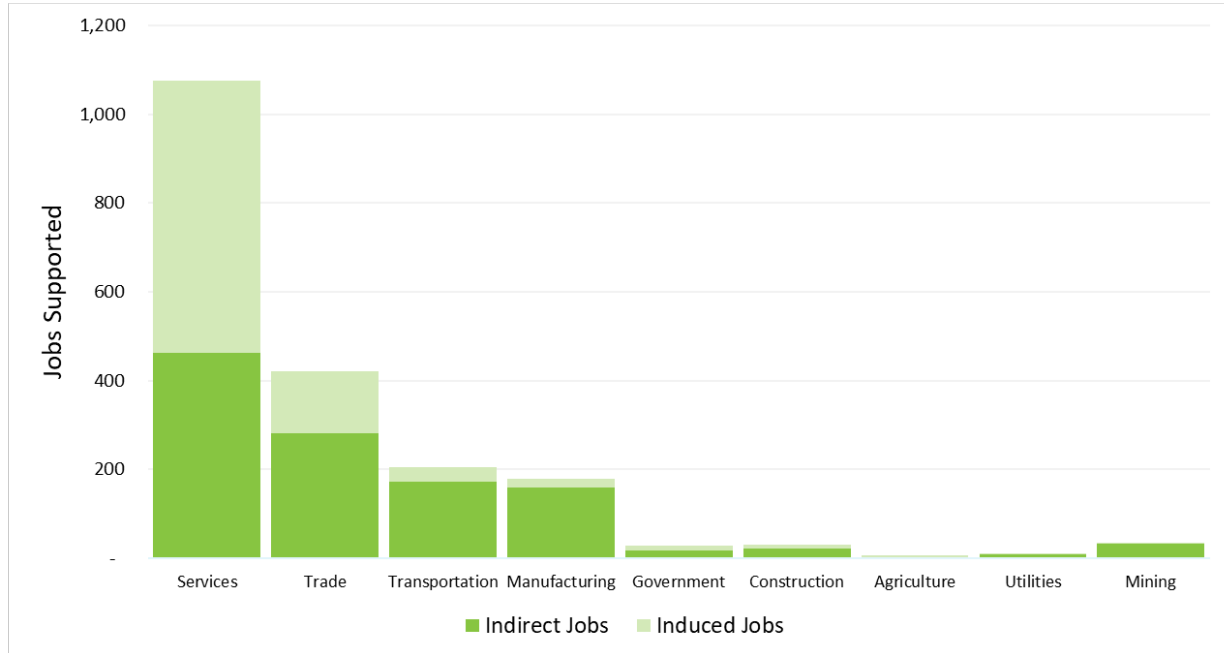
Source: Analysis by EDR Group based on industry survey and IMPLAN economic model for California.

By purchasing goods and services from suppliers and paying wages that workers spend throughout the economy after paying taxes, California’s lead battery industry supports a variety of industries (Figure 3). Over 1,000 of these supplier and worker spending jobs are in the services sector and about 800 jobs are in either trade, transportation, or manufacturing.

The reason such a variety of sectors benefit from the lead battery industry is because workers at individual companies and their suppliers spend their wages on food, housing, transportation, recreation, and other goods and services.

Figure 3. The California lead battery industry supports jobs in a variety of industry sectors.

Indirect & Induced Jobs Created by the California Lead Battery Industry in 2018



Source: IMPLAN analysis conducted by EDR Group.

Tax Revenue Contribution

By paying local, state, and federal taxes, companies in California’s lead battery industry contributed \$92.9 million in government revenue in 2018 (Table 6). The industry provided \$55.9 million in revenue to the federal government and \$37 million in revenue to states and localities.

Table 6. The California lead battery industry generates millions of dollars in tax revenue.

Tax Revenue Generated by the California Lead Battery Industry in 2018

Revenue Type	Revenue
Federal Tax Revenue	\$55.9 million
State and Local Tax Revenue	\$37.0 million
Total	\$92.9 million

Sources: Analysis by EDR Group based on the IMPLAN economic model and average rates for local, state, and federal taxes.

CONCLUSION

The California lead battery industry is comprised of battery manufacturing and lead recycling companies that also engage in transportation, distribution, and R&D. The industry is also supported by numerous suppliers, retailers, and marketing companies. In 2018, the lead battery industry directly supported 1,072 manufacturing, recycling, and transportation jobs plus an additional 77 R&D jobs, and had a total payroll of \$56.6 million.

Production by the lead battery industry also generated indirect impacts through transactions with its suppliers, and induced impacts through workers at both member companies and suppliers spending their earnings on goods and services. When direct, supplier, and worker spending impacts are combined, the industry contributed the following to the California economy in 2018:

- **3,056 jobs plus 77 R&D jobs;**
- **\$195.9 million in labor income;**
- **\$332.9 million in GSP; and**
- **\$998.6 million in output.**

These impacts are spread across a variety of industries, with services, trade, transportation, and manufacturing benefiting the most. Finally, by paying taxes, the lead battery industry contributes \$55.9 million annually in federal tax revenue and \$37 million annually in state and local tax revenue.

ABOUT EDR GROUP, AN EBP COMPANY

EDR Group was started with a core philosophy—to contribute to a better society by enhancing our understanding of economic processes and by improving the tools we have for decision-support regarding policies and investments. We focus on economic development and its relationship to public and private investments, programs and policies. The company maintains a select staff distinguished by three features: (1) technical excellence applying and furthering “state-of-the-art” analysis methods, (2) vision and leadership in communicating findings and helping clients use information for decision-making, and (3) ability to work effectively with others in teams to address client needs.

EDR Group initially built a practice based on evaluation of past projects, existing programs, and proposed future investments around North America. We have since expanded to serve a global clientele and to advise organizations on how to better implement processes for planning, prioritization, and funding decisions that consider wider benefit and impact factors. To further that objective, in 2016 we became an affiliate of EBP, an international group for interdisciplinary collaboration and innovation.

ABOUT BATTERY COUNCIL INTERNATIONAL

Battery Council International (BCI) is the North American trade association representing lead-based battery manufacturing, supply, recycling, and distribution companies. It exists to inform and educate stakeholders on the need for continued investment in sustainable battery technologies to store energy. BCI is committed to advancing lead battery innovation to support the integral role lead batteries play in powering our everyday lives. Learn more at www.batteryCouncil.org and www.essentialenergyeveryday.com.

APPENDIX

Methodology

This analysis was conducted based on 2018 industry data and using the most recently available IMPLAN economic model for California. All results are in 2018 dollars. A survey process was used to collect limited but key annual data from BCI member companies with activities in California. Compilation of the survey-derived and supplemental information represents direct impacts. The survey probed annual employment and payroll information by industry. The corresponding direct output (business sales or value of production) was estimated using output-to-jobs ratios from IMPLAN before summing output across companies within each of the subsectors comprising the BCI membership (i.e., manufacturing, recycling, transportation and distribution). There was one instance where direct payroll was estimated using an IMPLAN ratio because the survey respondent chose not to report annual payroll.

Definition of Terms

Input-output models are commonly used to conduct economic impact analysis. There are several input-output models available, including IMPLAN.¹² Many economists use IMPLAN for economic contribution analyses because the tool measures output and employment impacts, is available on a county-by-county basis, and is flexible for the user. IMPLAN has some limitations and qualifications, but it is one of the best tools available to economists for input-output modeling. Understanding the IMPLAN tool, its capabilities, and its limitations helps ensure the best results from the model. The California IMPLAN model used for this study estimates economic and tax revenue impacts at a statewide level. Tax revenue impacts include local, state, and federal revenue, estimated using average tax rates for each jurisdiction.

Several IMPLAN-specific definitions are essential to properly interpret the results of an IMPLAN analysis. These definitions follow, with some quoted directly from the IMPLAN glossary.¹³

¹² See www.implan.com for more information.

¹³ <https://implanhelp.zendesk.com/hc/en-us/categories/115001507908-Knowledge-Base>

Economic Contribution

Economic contribution represents a “gross change in economic activity associated with an industry, event or policy in an existing regional economy.”¹⁴ This is different from an economic impact, which represents a net change in economic activity.

Jobs

An IMPLAN job equals the annual average of monthly jobs in that industry (this is the same definition used by several government sources). Thus, one job lasting 12 months equals two jobs lasting six months each or three jobs lasting four months each. A job can be full-time or part-time.

Labor Income

Labor income includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income. Proprietor income consists of payments received by self-employed individuals and unincorporated business owners.

Value Added (GSP/GDP)

Value added or gross state/domestic product (GSP/GDP) represents the difference between an industry’s total output and the cost of its intermediate inputs (consumption of goods and services purchased from other industries or imported). Value added consists of employee compensation, taxes on production and imports less subsidies and gross operating surplus.

Output

Output represents the value of industry production. In IMPLAN these are annual production estimates for the year of the data set. For manufacturers, output equals sales plus or minus the change in inventory. For service sectors output equals sales. For retail and wholesale, trade output equals the gross margin and not gross sales.

Direct Impact

Direct impacts represent changes in industry production or expenditures resulting from companies that were surveyed. These initial changes are determined by an analyst to be a result of a specific activity (e.g., sales made by a given company). Applying these initial changes to the multipliers in an IMPLAN model will then display how the region will respond economically to these initial changes.

Indirect Impact (Supplier Impact)

Indirect impacts result from local industries buying goods and services from local supplier industries. As a company increases its production it will require more inputs from local suppliers, in turn increasing the production at those supplier companies. This indirect impact is calculated by applying direct effects to what are called Type I Multipliers.

¹⁴ Determining Economic Contributions and Impacts: What is the Difference and Why Do We Care? *The Journal of Regional Analysis and Policy* 37(2): 1-15, 2007.

Induced Impact (Worker Spending Impact)

Induced impacts represent the response of an economy to an initial (direct) change that occurs through re-spending of income. This money is recirculated through household spending patterns causing further local economic activity. A variety of industries benefit from induced impacts because workers at companies experiencing the initial change in production, plus workers at their local supplier companies, spend their wages on food, housing, transportation, recreation and other goods and services.

Total Impact

The total impact is the summation of the direct, indirect, and induced impacts.