

The Battery Fueled Economy: US Domestic and Supported Canadian Activity

EBP 

Batteries are used by industries, households and governments to support their day-to-day activity, as part of their business processes...

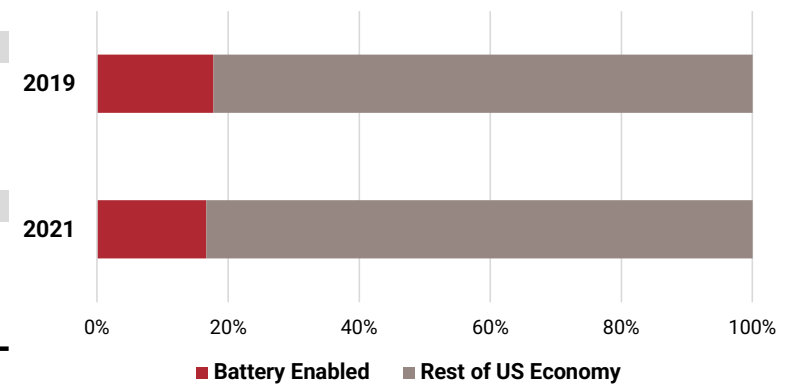
- Look at the downstream effects of domestically produced batteries in terms of
 - Supported economic activity within the US
 - Supported economic activity in Canada using US Exported Lead Batteries

Battery Impacts

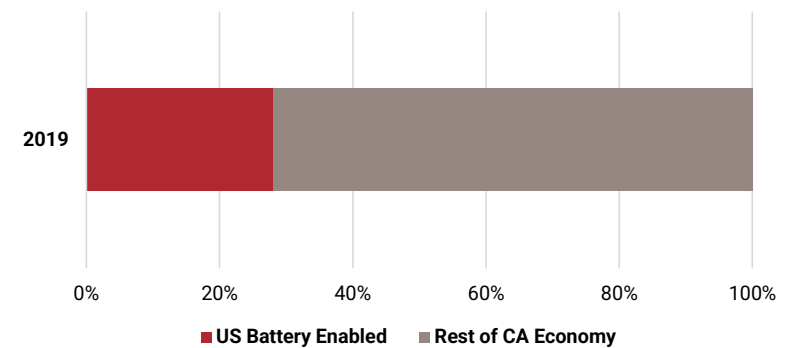
Battery Economies Supported (US):

	Employment	Income (\$M)	Value Added (\$M)	Output (\$M)
2019 Economic Contribution				
Downstream Industry Usage	55,179,577	\$ 3,203,513.2	\$ 4,506,157.0	\$ 8,223,949.0
Supported Through Sales to HH Demand	43,972	\$ 2,967.1	\$ 4,644.7	\$ 6,803.8
From Governmental Purchase	-	\$ -	\$ -	\$ 2,539.7
Total (2019)	55,223,549	\$ 3,206,480.3	\$ 4,510,801.7	\$ 8,233,292.5
2021 Economic Contribution				
Downstream Industry Usage	47,870,653	\$ 3,177,758.9	\$ 4,503,735.4	\$ 8,141,703.5
Supported Through Sales to HH Demand	89,940	\$ 7,513.0	\$ 10,575.4	\$ 15,085.3
From Governmental Purchase	-	\$ -	\$ -	\$ 7,528.8
Total (2021)	47,960,593	\$ 3,185,271.9	\$ 4,514,310.8	\$ 8,164,317.6

The Scale of US Battery Adjacent Economies



The Scale of Canada Battery Adjacent Economies (US Imports)



Battery Economics Supported (Canada Use of US Exports)

	Employment	Income (\$M)	Value Added (\$M)	Output (\$M)
2019 Economic Contribution				
Downstream Industry Usage	5,409,632	\$ 222.8	\$ 393.0	\$ 1,534.4
Supported Through Sales to HH Demand	-	-	-	\$ 224.5
From Governmental Purchases	353,389	\$ 28.8	\$ 40.6	\$ 148.9
Total (2019)	5,763,021	\$ 251.6	\$ 433.7	\$ 1,907.8

- **Downstream Industry Usage**
 - What it is: The proportion of domestic activity that is enabled by domestic manufacturing of storage batteries
 - How it is Captured: Identifying all US sectors which consume storage batteries and adjusting for their proportion of domestic versus international content.
 - **Important Note**: Government sector accounting of battery consumption in the US is split between programs like transit and other government enterprises (which fall under the industry usage sector) versus 'From Governmental Purchases'. Things like capital purchases for defense are recorded under 'Governmental Purchase'. This is why there is a government component under each.
- **Supported Through Sales to HH Demand**
 - What it is: The retail and wholesale sector receive a premium on top of the raw cost of the storage battery sector. This is referred to as a margin – and reflects their portion of the price paid, and accounts for their services rendered.
 - How it is Captured: The value of storage batteries being consumed by households is margined based on the proportion of how much of the price goes back to the manufacturer vs retailer.
- **From Governmental Purchase**
 - What it is: Budget items for purchasing of batteries in government programs (such as defense)
 - **Important Note**: Reporting of high-level budget purchases by commodity within the IMPLAN model. Note that the high-level purchases don't get into much more detail than a high-level line item – no jobs / income/ value added is associated with this purchasing given the lack of detail (only output is reported). This also means its very difficult to earmark and attribute this to things like defense spending explicitly.

Battery Enabled Economy: Combined, by Industry (US)



2019 US Economic Sectors Supported				
Industry Sector	Employment	Income (\$M)	Value Added (\$M)	Output (\$M)
Agriculture & Extraction	1,511,675	\$ 57,924.3	\$ 93,239.7	\$ 211,751.3
Utilities	-	\$ -	\$ -	\$ -
Construction	5,141,795	\$ 337,325.5	\$ 439,045.6	\$ 803,079.1
Manufacturing	352,356	\$ 40,273.2	\$ 89,141.0	\$ 321,272.8
Wholesale Trade	1,431,169	\$ 123,623.7	\$ 207,785.5	\$ 363,606.3
Retail Trade	7,204,227	\$ 266,348.6	\$ 435,594.9	\$ 709,324.4
Transportation	1,174,817	\$ 100,874.4	\$ 115,063.9	\$ 205,548.7
Postal & Warehousing	712,176	\$ 23,707.9	\$ 33,026.2	\$ 58,696.9
Media and Information	245,593	\$ 30,108.4	\$ 53,750.3	\$ 129,379.0
Financial Activities	7,784,363	\$ 486,657.0	\$ 935,872.2	\$ 1,871,463.5
Professional & Business	8,945,552	\$ 738,049.1	\$ 861,133.7	\$ 1,435,503.5
Education & Health	7,507,558	\$ 511,418.2	\$ 575,646.3	\$ 938,798.6
Other Services	12,787,101	\$ 450,276.8	\$ 598,038.2	\$ 1,040,840.8
Government	425,168	\$ 39,893.1	\$ 73,464.1	\$ 144,027.5
Total	55,223,549	\$ 3,206,480.3	\$ 4,510,801.7	\$ 8,233,292.5

2021 US Economic Sectors Supported				
Industry Sector	Employment	Income (\$M)	Value Added (\$M)	Output (\$M)
Agriculture & Extraction	1,319,809	\$ 68,200.1	\$ 97,965.9	\$ 224,331.4
Utilities	-	\$ -	\$ -	\$ -
Construction	4,533,801	\$ 322,252.8	\$ 411,597.4	\$ 818,187.6
Manufacturing	319,392	\$ 40,547.7	\$ 84,586.5	\$ 272,929.5
Wholesale Trade	1,229,727	\$ 118,485.9	\$ 223,166.1	\$ 390,966.4
Retail Trade	6,399,751	\$ 280,485.6	\$ 484,526.4	\$ 779,730.6
Transportation	1,030,635	\$ 92,296.0	\$ 109,351.9	\$ 226,045.7
Postal & Warehousing	820,138	\$ 29,029.1	\$ 47,928.5	\$ 75,057.6
Media and Information	236,245	\$ 35,662.9	\$ 58,163.1	\$ 151,163.3
Financial Activities	6,811,433	\$ 504,044.5	\$ 967,105.1	\$ 1,796,367.9
Professional & Business	7,928,304	\$ 736,794.9	\$ 865,496.8	\$ 1,424,026.7
Education & Health	6,687,837	\$ 499,253.1	\$ 542,160.7	\$ 865,323.6
Other Services	10,287,835	\$ 421,277.8	\$ 560,186.8	\$ 999,012.8
Government	355,685	\$ 36,941.5	\$ 62,075.4	\$ 141,174.5
Total	47,960,593	3,185,272	4,514,311	8,164,318

* This combines Downstream Industry Usage, Supported HH Demand, and Governmental Purchasing

Source: IMPLAN

Industry Sector	2019 CA Economic Sectors Supported			
	Employment	Income (\$M)	Value Added (\$M)	Output (\$M)
Agriculture & Extraction	182,408	\$ 10.1	\$ 35.9	\$ 135.1
Utilities	34,787	\$ 3.2	\$ 9.6	\$ 26.7
Construction	444,129	\$ 22.8	\$ 36.7	\$ 159.2
Manufacturing	480,129	\$ 27.6	\$ 46.5	\$ 332.4
Wholesale Trade	241,426	\$ 14.4	\$ 24.1	\$ 77.0
Retail Trade	630,422	\$ 17.9	\$ 25.0	\$ 81.3
Transportation	234,049	\$ 10.7	\$ 19.3	\$ 86.6
Postal & Warehousing	66,968	\$ 2.6	\$ 3.4	\$ 11.0
Media and Information	119,283	\$ 6.9	\$ 14.7	\$ 54.0
Financial Activities	408,137	\$ 22.5	\$ 56.4	\$ 194.8
Professional & Business	691,540	\$ 29.4	\$ 45.1	\$ 146.0
Education & Health	1,108,072	\$ 39.7	\$ 54.5	\$ 146.3
Other Services	768,284	\$ 15.0	\$ 21.7	\$ 84.0
Government	353,389	\$ 28.8	\$ 40.6	\$ 148.9
Total	5,763,021	252	434	1,683

* This combines Downstream Industry Usage, Supported HH Demand, and Governmental Purchasing

Takeaways: 2019 Storage Batteries Effects

- **\$2.5 billion** in demand for domestically produced batteries going towards government and defense spending
- **\$3.9 billion** worth of domestically produced storage batteries consumed by Households
 - Helps Generate **\$4.1 billion** in net sales for wholesale/retail outlets
 - \$758 million for Wholesale, \$3.4 billion for Retail
- **\$9.2 billion** worth of domestically produced storage batteries used by industries as part of their day-to-day operations
 - Fueling **\$8.2 trillion** worth of industrial economic output (roughly 22% of the economy)
- **\$578 million** worth of US lead battery exports used by the Canadian Economy
 - Supports **\$1.7 billion** worth of economic output, **\$224 million** in household consumption

Takeaways: 2021 Storage Batteries Effects

- **\$7.5 billion** in demand for domestically produced batteries going towards government and defense spending
- **\$6.7 billion** worth of domestically produced storage batteries consumed by Households
 - Helps Generate **\$7.1 billion** in net sales for wholesale/retail outlets
 - \$1.3 billion for Wholesale, \$5.8 billion for Retail
- **\$12.2 billion** worth of domestically produced storage batteries used by industries as part of their day-to-day operations
 - Fueling **\$8.1 trillion** worth of industrial economic output (roughly 20% of the economy)

(Cant estimate Canadian Effects for 2021)



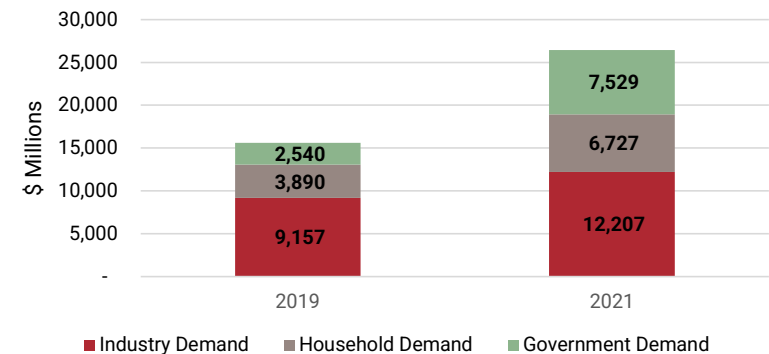
US Storage Battery Fueled Economic activity
Detail: Industry

US Downstream Usage of Batteries: Comparing 2019 & 2021

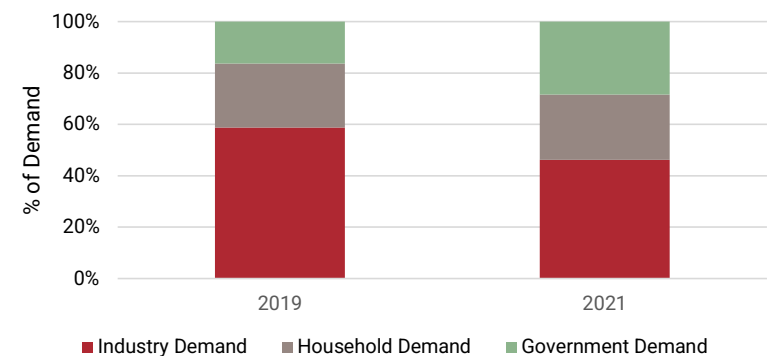


- Surging demand for storage batteries from pre to mid-COVID levels
 - Driven by strong growth in household demand
 - Regional Institution demand shifting from **41.3%** (in 2019) of battery demand up to **53.9%** by 2021
 - Driven by increase in household and government purchasing
 - Government sector includes defense contracting
- Overall demand increasing by almost **70%** despite economic downturn
 - \$15.6 billion in 2019
 - \$26.5 billion in 2021
 - **Net increase of \$10.9 billion**
- Roughly half of domestic demand from both sources was satisfied by imports in 2019 (50.4%, \$7.9 billion)
 - Rises to 55.5% in 2021 (\$14.7 billion)

US Demand for Domestically Produced Storage Batteries by Segment



US Demand for Domestically Produced Storage Batteries by Segment



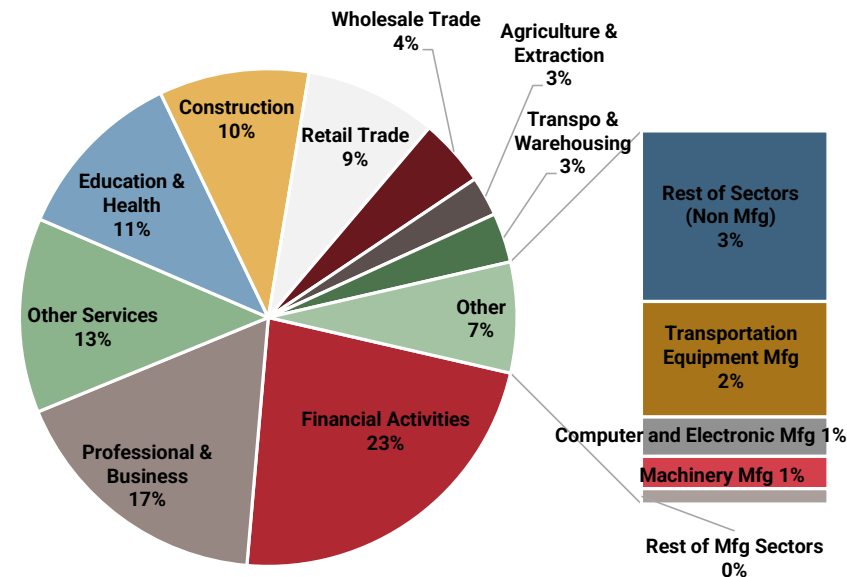
* Note model detail does not explicitly split technologies, though lead batteries is still leading the sector

Source: IMPLAN

US Downstream Usage of Batteries: 2019 Vision

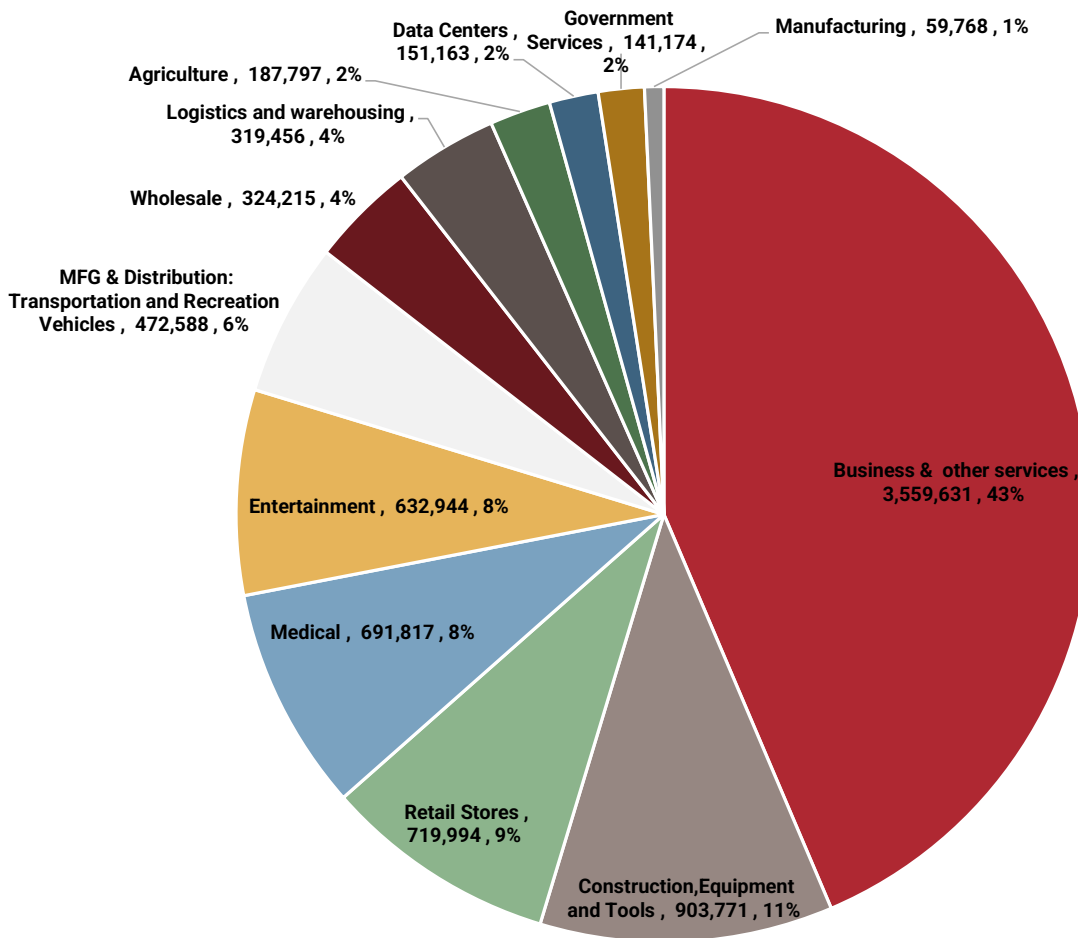
Economic Sector	2019 National Economic Summary					
	Battery Related		All National Activity		Fraction Total	
	Employment	Output (\$M)	Employment	Output (\$M)	Employment	Output
Agriculture & Extraction	1,511,675	93,240	4,917,075	1,030,251	31%	9%
Utilities	-	-	678,118	761,242	0%	0%
Construction	5,141,795	439,046	11,741,971	1,762,610	44%	25%
Manufacturing	352,356	89,141	13,574,792	7,078,016	3%	1%
Wholesale Trade	1,431,169	207,786	6,324,885	2,088,783	23%	10%
Retail Trade	7,204,227	435,595	17,275,779	1,676,880	42%	26%
Transportation	1,174,817	115,064	6,812,418	1,041,412	17%	11%
Postal & Warehousing	712,176	33,026	3,733,976	331,423	19%	10%
Media and Information	245,593	53,750	3,400,724	1,970,331	7%	3%
Financial Activities	7,784,363	935,872	20,175,137	7,373,560	39%	13%
Professional & Business	8,945,552	861,134	31,435,645	4,788,561	28%	18%
Education & Health	7,507,558	575,646	26,536,289	2,897,711	28%	20%
Other Services	12,787,101	598,038	34,138,810	2,760,814	37%	22%
Government	425,168	73,464	22,395,382	2,557,189	2%	3%
Total	55,223,549	4,510,802	203,141,000	38,118,783	27%	12%

Downstream Users of Storage Batteries
(2019, By Economic Output)



Source: IMPLAN

US Downstream Usage of Batteries: 2021 Vision (Alternate Aggregation)

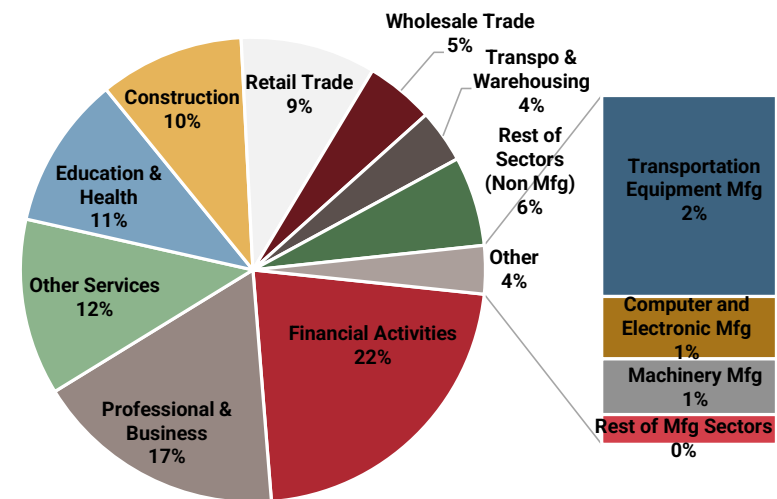


- Industry associated activity is all about the inputs that a company needs as part of its production process
- In many cases, the applications have more to do with downstream uses than industrial processes, so it's a complicated relationship that tends to be aggregated together in household or government demand applications within a more generic 'retail' or 'wholesale' that can't be easily split. Some of the things like 'data centers' are very much more to do with industrial use, and have been identified

US Downstream Usage of Batteries: 2021 Vision

Economic Sector	2021 National Economic Summary					
	Battery Related		All National Activity		Fraction Total	
	Employment	Output (\$M)	Employment	Output (\$M)	Employment	Output
Agriculture & Extraction	1,319,809	97,966	4,435,056	1,102,605	30%	9%
Utilities	-	-	677,243	827,266	0%	0%
Construction	4,533,801	411,597	11,573,603	2,012,780	39%	20%
Manufacturing	319,392	84,586	12,971,327	6,829,012	2%	1%
Wholesale Trade	1,229,727	223,166	6,144,933	2,416,049	20%	9%
Retail Trade	6,399,751	484,526	16,701,541	1,984,446	38%	24%
Transportation	1,030,635	109,352	6,093,618	1,023,133	17%	11%
Postal & Warehousing	820,138	47,929	4,276,630	424,822	19%	11%
Media and Information	236,245	58,163	3,279,074	2,358,154	7%	2%
Financial Activities	6,811,433	967,105	19,633,108	7,881,590	35%	12%
Professional & Business	7,928,304	865,497	31,354,532	5,301,614	25%	16%
Education & Health	6,687,837	542,161	26,164,174	2,970,573	26%	18%
Other Services	10,287,835	560,187	30,589,171	2,852,853	34%	20%
Government	355,685	62,075	21,778,791	2,731,522	2%	2%
Total	47,960,593	4,514,311	195,672,800	40,716,418	25%	11%

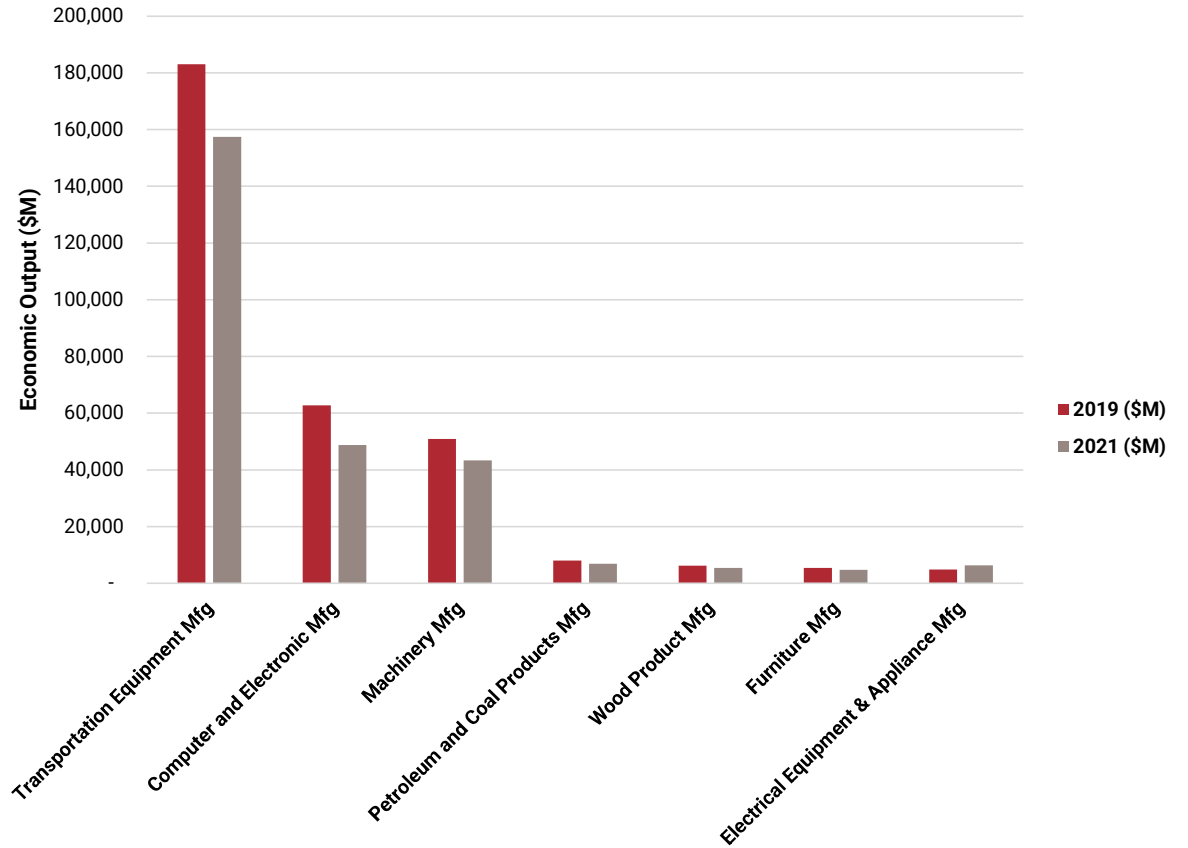
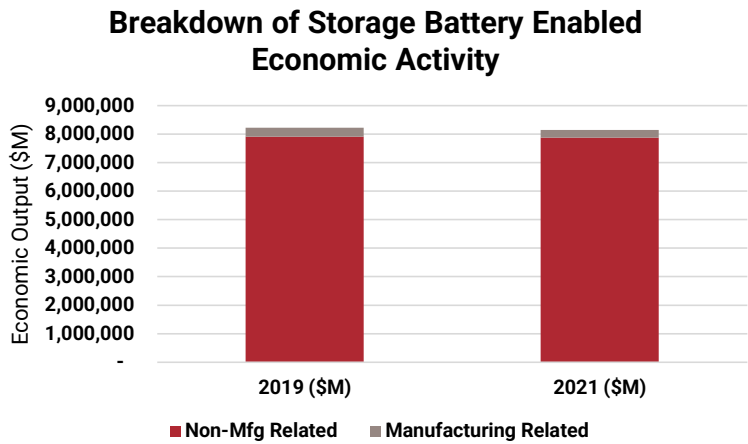
Downstream Users of Storage Batteries
(2021, By Economic Output)



Source: IMPLAN

Deeper Dive: Manufacturing Related Enabled Output (Industry Enabled only)

**Comparing Enabled Economic Output:
Manufacturing Related, 2019 v 2021**



Source: IMPLAN

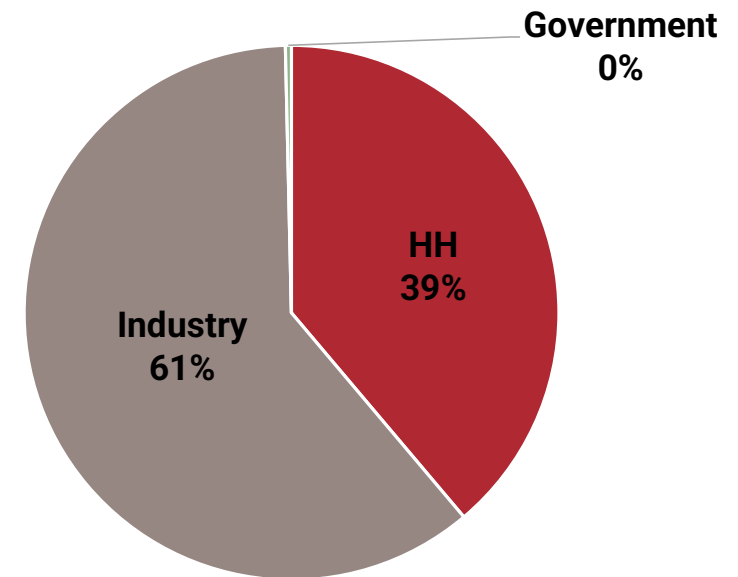


US Lead Battery Exports To Canada:
Supported Economic Activity

US Downstream Usage of Lead Batteries: 2019 Vision

Economic Sector	2019 National Economic Summary					
	Battery Related		All National Activity		Fraction Total	
	Employment	Output (\$M)	Employment	Output (\$M)	Employment	Output
Agriculture & Extraction	182,408	135	629,000	458	29%	29%
Utilities	34,787	27	116,620	89	30%	30%
Construction	444,129	159	1,488,915	534	30%	30%
Manufacturing	480,129	332	1,690,115	1,152	28%	29%
Wholesale Trade	241,426	77	809,365	258	30%	30%
Retail Trade	630,422	81	2,139,175	275	29%	30%
Transportation	234,049	87	784,635	290	30%	30%
Postal & Warehousing	66,968	11	224,505	37	30%	30%
Media and Information	119,283	54	399,890	181	30%	30%
Financial Activities	408,137	195	1,370,130	959	30%	20%
Professional & Business	691,540	146	2,318,345	490	30%	30%
Education & Health	1,108,072	146	3,714,745	490	30%	30%
Other Services	768,284	84	2,699,385	287	28%	29%
Government	353,389	149	1,184,715	499	30%	30%
Total	5,763,021	1,683	19,569,540	6,000	29%	28%

Canadian Use of US Lead Battery Imports



How much Canadian industrial economic activity is enabled through the usage of US imported lead acid batteries

Canadian Imports of US Lead Batteries and Associated



- Identify what HS commodity codes describe storage battery manufacturing (NAICS 33591)
- Gather subset to pull which are only related to lead batteries
- Gather Canadian import data on lead batteries coming from:
 - US, Rest of World
- Convert from USD to Canadian to make it work with Canadian Model

Key Commodities	2019 Canadian Imports (In USD, \$M)		
	USA (\$M)	Rest of World (\$M)	Total (All Sources)
Electric accumulators; lead-acid, used for starting piston engines	368.7	123.4	492.1
Electric accumulators; lead-acid, (other than for starting piston engines)	209.1	119.7	328.8
Total	577.8	243.1	820.9

Imports of US Lead Batteries
(2019 CAD \$M): **\$766.8**

2019 Exchange Rate: 1.3269

commodity	description	naics
8507100030	LEAD-ACID STORAGE BATTERIES, FOR PISTON ENGINES, 12 V, NOT EXCEEDING 6 KG IN WEIGHT	335911
8507100060	LEAD-ACID STORAGE BATTERIES, FOR PISTON ENGINES, 12 V, EXCEEDING 6 KG IN WEIGHT	335911
8507100090	LEAD-ACID STORAGE BATTERIES, FOR PISTON ENGINES, OTHER THAN 12 V	335911
8507200030	LEAD ACID STORAGE BATTERIES, 6 VOLTS, NESOI	335911
8507200040	LEAD ACID STORAGE BATTERIES, 12 VOLTS, NESOI	335911
8507200060	LEAD ACID STORAGE BATTERIES, 36 VOLTS, NESOI	335911
8507200090	LEAD ACID STORAGE BATTERIES, NESOI	335911
8507300000	NICKEL-CADMIUM STORAGE BATTERIES	335911
8507400000	NICKEL-IRON STORAGE BATTERIES	335911
8507500000	NICKEL-METAL HYDRIDE STORAGE BATTERIES	335911
8507600000	LITHIUM ION BATTERIES	335911
8507800002	STORAGE BATTERIES, NESOI	335911
8507904000	LEAD-ACID STORAGE BATTERY PARTS	335911
8507908000	STORAGE BATTERY PARTS (EXCEPT LEAD-ACID TYPE)	335911

Source: US Census Foreign Trade (Concordance), UN COMTRADE (Freight), Banque Du Canada (exchange)
<https://www.bankofcanada.ca/rates/exchange/annual-average-exchange-rates/>

Canadian Usage of Batteries (Splitting out Sector)

- Battery consumption is generalized in economic model to **Other electrical equipment and component manufacturing**
- Can use other economic accounts put out by STATSCAN to break this apart, but data only available for 2019

Canadian Industry Sector (STATSCAN)	Batteries and battery chargers [MPG335901]	Communication and electric wire and cable [MPG335902]	Wiring devices [MPG335903]	Other electrical equipment and components [MPG335909]	%Battery
Crop production (except cannabis, greenhouse, nursery and floriculture production) [BS111A00]	12890	1728	16753	21481	24.4%
Greenhouse, nursery and floriculture production (except cannabis) [BS1114A0]	469	120	771	941	20.4%
Cannabis production (licensed) [BS111CL0]	230	37	382	402	21.9%
Animal production (except aquaculture) [BS112A00]	3960	746	5810	7293	22.2%
Aquaculture [BS112500]	516	155	992	630	22.5%
Forestry and logging [BS113000]	6971	3259	13793	15042	17.8%
Fishing, hunting and trapping [BS114000]	2394	367	3929	2484	26.1%
Support activities for crop and animal production [BS115A00]	50	0	98	96	20.5%

(Example screenshot from model, first couple sectors)



Methodology

- Use the Storage Battery Sector in IMPLAN to determine the pattern of who uses batteries
 - Focus on businesses vs households to look at relative splits and where the downstream demand is located
- For estimates of the size of the economy which uses battery technology, take that demand and only associate impacts from the domestic content portion (we do not count the economic activity of HH demand that is being satisfied from international sources)

Impact estimation methodology

- If total battery consumption amounts to any nonzero value (for example say only 2%) of inputs to production, then that industry's economic activity is counted. The logic is that Batteries are a very small component of a much bigger product, but they are still a necessary component and therefore are key to the technology and should count towards reliance.
 - We net out the effects of imported demand. So for the same example where we said that only 2% of inputs to production were battery related, lets say maybe half of that was satisfied by imported demand (1% overall demand). That would imply that 50% of battery reliance was tied to US producers, therefore instead of 100% of that sector's economic activity, we would count only 50% of it.
- All of this is done for each of the 544 sectors within the economic model spanning both goods and services sectors. Some sectors simply do not consume batteries, and therefore they do not contribute anything towards the reliant economy count.

- Gather the following tables for making the model:
 - STATSCAN Symmetric Input Output table (identify users)
 - STATSCAN Use Table (to give breakout on electronics sector for how much is battery and charger related)
 - UN COMTRADE data
 - Identify how much imported content is coming from US versus all other countries
 - Identify how much of imported Electronics is battery related
 - Identify how much of imported batteries is lead related versus not
- Identify percentage of industry and HH demand that is battery related
- Use previous step to feed imported goods through the economy to businesses and households
- Estimate associated accompanying Employment, Income, Value Added, Output from usage