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):

<table>
<thead>
<tr>
<th></th>
<th>Employment</th>
<th>Income ($)</th>
<th>Value Added ($)</th>
<th>Output ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2019 Economic Contribution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downstream Industry Usage</td>
<td>55,179,577</td>
<td>$3,203,513.2</td>
<td>$4,506,157.0</td>
<td>$8,223,949.0</td>
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<tr>
<td>Supported Through Sales to HH Demand</td>
<td>43,972</td>
<td>$2,967.1</td>
<td>$4,644.7</td>
<td>$6,803.8</td>
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<tr>
<td>From Governmental Purchase</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>$2,539.7</td>
</tr>
<tr>
<td><strong>Total (2019)</strong></td>
<td>55,223,549</td>
<td>$3,206,480.3</td>
<td>$4,510,801.7</td>
<td>$8,233,292.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Employment</th>
<th>Income ($)</th>
<th>Value Added ($)</th>
<th>Output ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2021 Economic Contribution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Downstream Industry Usage</td>
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<td>Supported Through Sales to HH Demand</td>
<td>89,940</td>
<td>$7,513.0</td>
<td>$10,575.4</td>
<td>$15,085.3</td>
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<tr>
<td>From Governmental Purchase</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>$7,528.8</td>
</tr>
<tr>
<td><strong>Total (2021)</strong></td>
<td>47,960,593</td>
<td>$3,185,271.9</td>
<td>$4,514,310.8</td>
<td>$8,164,317.6</td>
</tr>
</tbody>
</table>

## The Scale of US Battery Adjacent Economies

- **Battery Enabled**
- **Rest of US Economy**

## Battery Economics Supported (Canada Use of US Exports):

<table>
<thead>
<tr>
<th></th>
<th>Employment</th>
<th>Income ($)</th>
<th>Value Added ($)</th>
<th>Output ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2019 Economic Contribution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downstream Industry Usage</td>
<td>5,409,632</td>
<td>$222.8</td>
<td>$393.0</td>
<td>$1,534.4</td>
</tr>
<tr>
<td>Supported Through Sales to HH Demand</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>$224.5</td>
</tr>
<tr>
<td>From Governmental Purchases</td>
<td>353,389</td>
<td>$28.8</td>
<td>$40.6</td>
<td>$148.9</td>
</tr>
<tr>
<td><strong>Total (2019)</strong></td>
<td>5,763,021</td>
<td>$251.6</td>
<td>$433.7</td>
<td>$1,907.8</td>
</tr>
</tbody>
</table>

## The Scale of Canada Battery Adjacent Economies (US Imports)

- **US Battery Enabled**
- **Rest of CA Economy**

Source: IMPLAN, STATSCAN
Battery Impacts: Terminology

- **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

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Employment</th>
<th>Income ($M)</th>
<th>Value Added ($M)</th>
<th>Output ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; Extraction</td>
<td>1,511,675</td>
<td>$57,924.3</td>
<td>$93,239.7</td>
<td>$211,751.3</td>
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<tr>
<td>Utilities</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Construction</td>
<td>5,141,795</td>
<td>$337,325.5</td>
<td>$439,045.6</td>
<td>$803,079.1</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>352,356</td>
<td>$40,273.2</td>
<td>$89,141.0</td>
<td>$321,272.8</td>
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<tr>
<td>Wholesale Trade</td>
<td>1,431,169</td>
<td>$123,623.7</td>
<td>$207,785.5</td>
<td>$363,606.3</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>7,204,227</td>
<td>$266,348.6</td>
<td>$435,594.9</td>
<td>$709,324.4</td>
</tr>
<tr>
<td>Transportation</td>
<td>1,174,817</td>
<td>$100,874.4</td>
<td>$115,063.9</td>
<td>$205,548.7</td>
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<tr>
<td>Postal &amp; Warehousing</td>
<td>712,176</td>
<td>$23,707.9</td>
<td>$33,026.2</td>
<td>$58,696.9</td>
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<tr>
<td>Media and Information</td>
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<tr>
<td>Other Services</td>
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<tr>
<td><strong>Total</strong></td>
<td>55,223,549</td>
<td>$3,206,480.3</td>
<td>$4,510,801.7</td>
<td>$8,233,292.5</td>
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</tbody>
</table>

#### 2021 US Economic Sectors Supported

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Employment</th>
<th>Income ($M)</th>
<th>Value Added ($M)</th>
<th>Output ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; Extraction</td>
<td>1,319,809</td>
<td>$68,200.1</td>
<td>$97,965.9</td>
<td>$224,331.4</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Construction</td>
<td>4,533,801</td>
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<td>Manufacturing</td>
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<td>$272,929.5</td>
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<tr>
<td>Wholesale Trade</td>
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<tr>
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<tr>
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<td>$141,174.5</td>
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<tr>
<td><strong>Total</strong></td>
<td>47,960,593</td>
<td>$3,185,272</td>
<td>$4,514,311</td>
<td>$8,164,318</td>
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</table>

*This combines Downstream Industry Usage, Supported HH Demand, and Governmental Purchasing*
<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Employment</th>
<th>Income (SM)</th>
<th>Value Added (SM)</th>
<th>Output (SM)</th>
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</thead>
<tbody>
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<td>$135.1</td>
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<td>$3.2</td>
<td>$9.6</td>
<td>$26.7</td>
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<td>Construction</td>
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<td>$159.2</td>
</tr>
<tr>
<td>Manufacturing</td>
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<td>Transportation</td>
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<td>$10.7</td>
<td>$19.3</td>
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<td>$22.5</td>
<td>$56.4</td>
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<td>Professional &amp; Business</td>
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<td>$45.1</td>
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<td>$146.3</td>
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<td>Other Services</td>
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<td>Government</td>
<td>353,389</td>
<td>$28.8</td>
<td>$40.6</td>
<td>$148.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,763,021</strong></td>
<td><strong>252</strong></td>
<td><strong>434</strong></td>
<td><strong>1,683</strong></td>
</tr>
</tbody>
</table>

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

Source: IMPLAN
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

- 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)

*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

### 2019 National Economic Summary

<table>
<thead>
<tr>
<th>Economic Sector</th>
<th>Battery Related</th>
<th>2019 National Economic Summary</th>
<th>Fraction Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employment</td>
<td>All National Activity</td>
<td>Employment</td>
</tr>
<tr>
<td></td>
<td>Output ($M)</td>
<td>Output ($M)</td>
<td>Output ($M)</td>
</tr>
<tr>
<td>Agriculture &amp; Extraction</td>
<td>1,511,675</td>
<td>93,240</td>
<td>4,917,075</td>
</tr>
<tr>
<td>Utilities</td>
<td>-</td>
<td>-</td>
<td>678,118</td>
</tr>
<tr>
<td>Construction</td>
<td>5,141,795</td>
<td>439,046</td>
<td>11,741,971</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>352,356</td>
<td>89,141</td>
<td>13,574,792</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>1,431,169</td>
<td>207,786</td>
<td>6,324,885</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>7,204,227</td>
<td>435,595</td>
<td>17,275,779</td>
</tr>
<tr>
<td>Transportation</td>
<td>1,174,817</td>
<td>115,064</td>
<td>6,812,418</td>
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<tr>
<td>Postal &amp; Warehousing</td>
<td>712,176</td>
<td>33,026</td>
<td>3,733,976</td>
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<td>Media and Information</td>
<td>245,593</td>
<td>53,750</td>
<td>3,400,724</td>
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<td>Financial Activities</td>
<td>7,784,363</td>
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<td>20,175,137</td>
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<td>Professional &amp; Business</td>
<td>8,945,552</td>
<td>861,134</td>
<td>31,435,645</td>
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<tr>
<td>Education &amp; Health</td>
<td>7,507,558</td>
<td>575,646</td>
<td>26,536,289</td>
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<tr>
<td>Other Services</td>
<td>12,787,101</td>
<td>598,038</td>
<td>34,138,810</td>
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<tr>
<td>Government</td>
<td>425,168</td>
<td>73,464</td>
<td>22,395,382</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55,223,549</strong></td>
<td><strong>4,510,802</strong></td>
<td><strong>203,141,000</strong></td>
</tr>
</tbody>
</table>

Source: IMPLAN
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

#### 2021 National Economic Summary

<table>
<thead>
<tr>
<th>Economic Sector</th>
<th>Battery Related</th>
<th>All National Activity</th>
<th>Fraction Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employment</td>
<td>Output ($M)</td>
<td>Employment</td>
</tr>
<tr>
<td>Agriculture &amp; Extraction</td>
<td>1,319,809</td>
<td>97,966</td>
<td>1,102,605</td>
</tr>
<tr>
<td>Utilities</td>
<td>-</td>
<td>-</td>
<td>827,266</td>
</tr>
<tr>
<td>Construction</td>
<td>4,533,801</td>
<td>411,597</td>
<td>2,012,780</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>319,392</td>
<td>84,586</td>
<td>6,829,012</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>1,229,727</td>
<td>11,573,603</td>
<td>2,416,049</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>6,399,751</td>
<td>484,526</td>
<td>1,984,446</td>
</tr>
<tr>
<td>Transportation</td>
<td>1,030,635</td>
<td>109,352</td>
<td>1,023,133</td>
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<tr>
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<td>Media and Information</td>
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<td>5,301,614</td>
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<tr>
<td>Education &amp; Health</td>
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<td>542,161</td>
<td>2,970,573</td>
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<tr>
<td>Other Services</td>
<td>10,287,835</td>
<td>560,187</td>
<td>2,852,853</td>
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<tr>
<td>Government</td>
<td>355,685</td>
<td>62,075</td>
<td>2,731,522</td>
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<tr>
<td>Total</td>
<td>47,960,593</td>
<td>4,514,311</td>
<td>40,716,418</td>
</tr>
</tbody>
</table>

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

Comparing Enabled Economic Output: Manufacturing Related, 2019 v 2021

Breakdown of Storage Battery Enabled Economic Activity

Source: IMPLAN
US Lead Battery Exports To Canada: Supported Economic Activity
How much Canadian industrial economic activity is enabled through the usage of US imported lead acid batteries

<table>
<thead>
<tr>
<th>Economic Sector</th>
<th>Battery Related</th>
<th>2019 National Economic Summary</th>
<th>Fraction Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employment</td>
<td>Output ($M)</td>
<td>Employment</td>
</tr>
<tr>
<td>Agriculture &amp; Extraction</td>
<td>182,408</td>
<td>135</td>
<td>629,000</td>
</tr>
<tr>
<td>Utilities</td>
<td>34,787</td>
<td>27</td>
<td>116,620</td>
</tr>
<tr>
<td>Construction</td>
<td>444,129</td>
<td>159</td>
<td>1,488,915</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>480,129</td>
<td>332</td>
<td>1,690,115</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>241,426</td>
<td>77</td>
<td>809,365</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>630,422</td>
<td>81</td>
<td>2,139,175</td>
</tr>
<tr>
<td>Transportation</td>
<td>234,049</td>
<td>87</td>
<td>784,635</td>
</tr>
<tr>
<td>Postal &amp; Warehousing</td>
<td>66,968</td>
<td>11</td>
<td>224,505</td>
</tr>
<tr>
<td>Media and Information</td>
<td>119,283</td>
<td>54</td>
<td>399,890</td>
</tr>
<tr>
<td>Financial Activities</td>
<td>408,137</td>
<td>195</td>
<td>1,370,130</td>
</tr>
<tr>
<td>Professional &amp; Business</td>
<td>691,540</td>
<td>146</td>
<td>2,318,345</td>
</tr>
<tr>
<td>Education &amp; Health</td>
<td>1,108,072</td>
<td>146</td>
<td>3,714,745</td>
</tr>
<tr>
<td>Other Services</td>
<td>768,284</td>
<td>84</td>
<td>2,699,385</td>
</tr>
<tr>
<td>Government</td>
<td>353,389</td>
<td>149</td>
<td>1,184,715</td>
</tr>
<tr>
<td>Total</td>
<td>5,763,021</td>
<td>1,683</td>
<td>19,569,540</td>
</tr>
</tbody>
</table>

Source: STATSCAN, UN COMTRADE
### 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

<table>
<thead>
<tr>
<th>Description</th>
<th>USA (SM)</th>
<th>Rest of World (SM)</th>
<th>Total (All Sources)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric accumulators; lead-acid, used for starting piston engines</td>
<td>368.7</td>
<td>123.4</td>
<td>492.1</td>
</tr>
<tr>
<td>Electric accumulators; lead-acid, (other than for starting piston engines)</td>
<td>209.1</td>
<td>119.7</td>
<td>328.8</td>
</tr>
<tr>
<td>Total</td>
<td>578.8</td>
<td>243.1</td>
<td>820.9</td>
</tr>
</tbody>
</table>

#### Imports of US Lead Batteries

(2019 CAD $M): **$766.8**

2019 Exchange Rate: 1.3269

Source: US Census Foreign Trade (Concordance), UN COMTRADE (Freight), Banque Du Canada (exchange)

https://www.bankofcanada.ca/rates/exchange/annual-average-exchange-rates/
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

(Example screenshot from model, first couple sectors)
Methodology
US Downstream Usage of Batteries: Process

- 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.
CA Downstream Usage of US Lead Battery Imports: Process

- 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