# The State of the Global Race for Batteries: United States

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- **3** U.S. Battery Policy and Strategy



## **U.S. Energy-Related CO<sub>2</sub> Emissions by Sector**

Figure 4: Energy-related CO<sub>2</sub> emissions by sector





Source: EIA and Rhodium US Climate Service

Source: Rhodium Group, March 2018



### **U.S. Grid-Connected Storage Installations through 2016**



#### Figure 6. U.S. Large-Scale Battery Storage Capacity by Chemistry (2003–2016)

Source: U.S. Energy Information Administration, Form EIA-860, Annual Electric Generator Report



Source: EIA, May 2018

#### **U.S. Grid-Connected Storage Deployment Forecast through** 2023

U.S. Annual Energy Storage Deployment Forecast, 2012-2023E (MWh)



Source: GTM Research/Energy Storage Assn., Sept 2018



## **U.S. Plug-In Car Sales**





Source: Inside EVs, October 2018

#### Projected All-Electric Vehicle Sales in North America, 2015-2030



Source: Bank of America, Merrill Lynch, 2017



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## **U.S. Li-ion Battery Production Capacity in Context**



## EV and Battery Pack Trade: Cumulative, 2010-2017



**Figure 1.** Cumulative electric vehicles sales and production from 2010 through 2017, in major regions, with circle size proportional to the percentage of global electric vehicles produced.

#### Electric vehicles: US a slight net importer



**Figure 6.** Electric vehicle production and battery production for five major electric vehicle manufacturing regions in 2017, with circle sizes proportional to the percentage of global electric vehicle production.

#### Battery packs: US a heavy net importer

Source: International Council for Clean Transportation, May 2018



## **N.** American Li-ion Battery Production Capacity Projection



Source: Benchmark Mineral Intelligence, July 2018

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## **U.S. Li-ion Battery Production Capacity Projection**



Source: Benchmark Mineral Intelligence, Sept 2018



#### **Tesla's Giga-Factory: Ahead of Schedule**





Source: Clean Technica, Oct 2018

#### **Tesla Sales Take Off**





Source: EV Volumes, current

## **Beyond Tesla: Not Much, Yet**



Above: LG Chem, Holland, MI Upper right: Nissan AESC, Smyrna, TN Lower right: Magnis Resources, Endicott, NY (planned location)



Figure 4: Huron Campus, the location of the Imperium3 New York Lithium-ion battery plant

Sources: Holland Sentinel, Magnis Resources, Greentech Media

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## Obama Surge...

- ARRA: \$1.5 billion in cost-shared grants across battery supply chain
  - Approx. \$1 billion to Li-ion battery factories (including Holland, MI)
- LPO: \$8.5 billion in loan guarantees to EV manufacturers
  - Including Tesla, Nissan, and Ford
- Significant increases in battery R&D

- Including EERE VTO & OE ES, ARPA-E, and JCESR



## ... Reverts to Business as Usual

- States go "buffalo hunting"
  - Michigan
  - New York
  - Nevada
  - Etc.

#### Tesla's Reported Incentive Package from Nevada



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Source: Reno Gazette Journal, Sept 2014

### **Factors Determining Battery Production Location**

- Supply chain (costs, reliability, etc.)
- Production know-how
- OEM vertical integration
- Shipping costs
- Policy, domestic and international (subsidies, incentives, tariffs, etc.)



Figure 5-4. Flow of Li-ion cells (for all applications) between key trading partners, 2014. Darker shades represent exports; lighter shades represent imports.

Global Flows of Lithium-Ion Cells in 2014 Source: NREL CEMAC. 2017

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## **Federal Policy Priorities**

- EV and grid storage market development
- R&D investment (including manufacturing)
- Lab-to-market technology transfer
- International technology transfer
- Scale-up capital for new entrants
- Fair trade
- State incentive "race to the bottom"



EXHIBIT 3 | Factory-of-the-Future Concepts Are Essential to Reducing Costs

Battery Cost Reduction Opportunities Source: BCG, Sept. 2018

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# **Thank You!**

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