Is U.S. Dependence on China for the Battery Supply Chain a National Security Risk?

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September 2023

Introduction

While minerals necessary for the clean energy transition such as lithium, cobalt, copper, and graphite are sourced from various countries, China dominates their processing and other steps along the battery supply chain.[1] A 2022 report for the U.S. Department of Defense notes: "China dominates the global advanced battery supply chain, including lithium hydroxide (94 percent), cells (76 percent), electrolyte (76 percent), lithium carbonate (70 percent), anodes (65 percent), and cathodes (53 percent)."[2]

U.S. reliance on imports for some minerals and some pieces of the battery supply chain is pronounced. In their 2022 assessment of supply chain risks, Davidson et al. noted that the U.S. at the time did not refine nickel or cobalt and had minimal capacity to refine lithium. They noted that the U.S. produced less than 10% of the subcomponents for batteries. According to UN data, some 80% of U.S. battery imports in 2022 by value were sourced from China.[3] In 2022, the United States imported 100% of natural graphite, another important mineral for batteries, a third of it from China.[4] Even with enhanced production, Benchmark Source estimates that North American cathode and anode production would only amount to 4% and 3% of domestic demand by 2030.[5]

Is U.S. dependence on Chinese inputs for batteries a national security risk? And, if so, how should policymakers think about the boundaries of what Chinese investment and inputs should be allowed in to the United States on national security grounds?

This short memo explores the narrow national security argument based on the dual use of batteries in military technologies. I also discuss if there are national security risks, how to reconcile the trade-off with increased on-shoring and ally-shoring of production with the potential for slowing down the clean energy transition due to higher costs and lower efficiencies.

The National Security Rationale

One of President Biden's first moves was to sign Executive Order 14017 in February 2021 which mandated a 100-day supply chain review of risks to a variety of supply chains including high-capacity batteries and critical minerals.[6] One of the main justifications for U.S. diversification strategies in the battery and minerals space is based on national security.

In a 2022 presentation to an industry batteries conference, DOD official Matthew Zolnowski articulated the security risks of dependence: "The United States is highly reliant on adversarial sources for all of the materials required for these batteries. U.S. adversaries have a demonstrated pattern of using their economic power in critical materials markets to harm the U.S. / allied industrial base, and the possible

[1] Bazilian, Holland, and Busby 2023.
[2] U.S. Department of Defense 2022, 19.
[3] World Economic Forum 2023.
[4] U.S. Geological Survey 2023.
[5] Benchmark Source 2022.
[6] The White House 2021a.

exertion of that strength against the defense industrial base and domestic critical infrastructure poses a risk to the United States."[7]

Similar logics have been expressed in other documents. The Biden Administration's 2021 100-Day Supply Chain Review report noted: "Given the similar history of Chinese non-market intervention in the solar and rare earth industries, and China's stated intentions in the Made in China 2025 initiative, there is cause for concern that, without a proactive response from the United States, this growing field will face those same challenges."[8]

The Extended National Security Logic

I previously explored some of these issues in a memo for a project supported by the UT Energy Institute. The extended national security rationale for on-shoring production of batteries and parts of the supply chain is that electric vehicles and battery storage will be central sources of profit generation in the 21st century. Countries that are able to reap large economic rewards from batteries will be able to generate fungible wealth to support their military power. Allowing China as a peer competitor to dominate that economic space would mean that the United States would be somewhat economic poorer than it otherwise might. This suggests that a country's source of comparative advantage might be dynamic and influenced by government policy, namely industrial policy.[9]

The Narrow National Security Logic

The more limited national security concern that animates current policy is that China will attempt to disrupt exports to the United States for battery supply chains because of policy disputes or as a result of a military conflict. The salience of these concerns was underscored in the wake of Russia's invasion of Ukraine and amidst European dependence on Russian gas and oil exports. In this vein, academic analysts have highlighted the risks of *weaponized interdependence,* where countries use trade ties between them for coercive leverage.[10]

The question with respect to the battery supply chain is whether China has (1) the willingness to try to use its domination of the battery supply chain coercively and (2) whether those moves would be effective.

One precedent is China's efforts to pressure Japan in 2010 with threats to interrupt trade in rare earth metals. Of more recent relevance is the announcement in summer 2023 that China might restrict exports of gallium and germanium to the United States. Both suggest a willingness by China to try to use its leverage as a coercive tool.

However, scholars have raised doubts about the efficacy of these efforts. For one, Japan was able to diminish its vulnerability to China on rare earths through development of alternative supplies, despite China's dominance of the supply chain, Japan being a major consumer of rare earths, and the importance of rare earths to Japan's economy.[11]

[7] Zolnowski 2022.
[8] The White House 2021b, 92–93.
[9] Busby and Orszag 2023.
[10] Farrell and Newman 2019.
[11] Gholz and Hughes 2021.

This, however, does not refute China's willingness to use such methods, though casts doubt on their efficacy. While the Japan rare earths episode suggests China may realize such coercion is likely to backfire, authoritarian regimes with power increasingly centralized under the control of a single individual (as China increasingly has become) are more likely to make such costly miscalculations. Putin's decision to invade all of Ukraine is another data point.

Already, analysts think China's gambit on germanium and gallium was a mistake, as it has affirmed U.S. fears of China's intentions, hastened a search for alternatives, and importers have reserves in any case.[12] Nevertheless, with fewer internal checks on President Xi, China may be willing to try to use its domination of the battery space for coercive leverage.

In terms of efficacy of using battery supply chains as a coercive tool, there are other sources of criticism. As numerous observers have noted, interruptions in delivery of batteries and minerals supply chains will have a different result than say interruption of gas or oil supplies, which can readily translate into energy supply shortages in the short-run. Should there be interruptions in batteries, components, or minerals, that would merely slow the transition to cleaner energy but would on their own not contribute to energy shortfalls, particularly at low levels of EV and batteries penetration.[13] As Jason Bordoff and Meghan O'Sullivan wrote: "But inputs for clean energy products that produce or store energy are not the same as the energy itself. If China did restrict exports of solar panels or batteries, the lights would not go out."[14]

These concerns notwithstanding, batteries will become more central to the U.S. economy and national security as electric vehicles and battery storage become more ubiquitous. Perhaps the parallel is semi-conductor chips, where the supply chain disruption in 2021 was estimated to cost the U.S. economy some $240 billion.[15]

In terms of national security, a supply chain disruption in minerals and batteries, as systems become more reliant on them, could mean the U.S. lacks the components to build weapons systems. As the 2022 DOD report on implementing President Biden's Executive Order 14017 noted, "U.S. reliance on sole-source suppliers and foreign sources poses risks to domestic capability and capacity to produce kinetic capabilities."[16]

With respect to "high-capacity" batteries,[17] there are a variety of kinetic capabilities that rely on them, and the Department of Defense also increasingly uses batteries for non-kinetic capabilities as it electrifies non-tactical vehicles and installs more on-site battery storage at military bases. As Deputy Secretary of Defense Kathleen Hicks noted, "batteries are also essential to thousands of military systems, from handheld radios to unmanned submersibles and to future capabilities like lasers, directed energy weapons, and hybrid electric tactical vehicles."[18]

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[12] Lasley 2023.
[13] Busby and Orszag 2023; Davidson et al. 2022.
[14] Bordoff and O'Sullivan 2022.
[15] Villafranca 2022.
[16] U.S. Department of Defense 2022, 14.
[17] The Biden Administration defined high-capacity as follows: "'high-capacity' cells are defined as having a gravimetric energy density of 200 watt-hour per kilogram (Wh/kg) or greater. For reference, the Tesla Model 3 uses cells that deliver 240 Wh/kg, and many other commercially available EV battery cells approach that capacity, so 200 Wh/kg and above is well inclusive of the range of current technology." The White House et al. 2021, 89.
[18] U.S. Department of Defense 2021.

In a presentation to an industry conference, DOD official Joe Sopcisak enumerated a variety of other battery powered capabilities including for *special operations* (swimmer propulsion, night vision goggles, radio batteries, MRZR - silent mobility), *counter-insurgency* (counter improved explosive devices, MUTT ground logistics, Raven unmanned aerial vehicles, JLTV - silent watch), and *great power conflict* (MQ-25 Aerial Refueler, High Energy Laser Counter-ASCM Program (HELCAP), AOEW counter-ship missile, Orca mining/mine countermeasures, Joint Strike Fighter, Switchblade – loitering munition, M1 Abrams – silent watch, Howitzer – artillery, THAAD – counter ballistic, and satellite systems.[19]

Davidson et al. recognize that batteries have increasing relevance for military purposes and code the national security risks of dependence on China as medium, writing of various clean energy technologies: "except for batteries that have some high-performance military applications, the risks to dual-use technology development appear minimal."[20] They note that national security restrictions can include export controls (on domestic firms), restrictions on investment (by foreign firms), and more domestic sourcing to reduce reliance on foreign suppliers.

Options, Onshoring, and The Risks of Overzealous Decoupling

How then should the U.S. government think about these options? Given long lead times to build mines and factories, the risk of a battery supply chain disruption (in the absence of stockpiles and domestic or allied manufacturing capacity) could mean, at worst, a multi-year shortage of components for batteries necessary for defense purposes.

Crash programs might be able to sources minerals and develop production capabilities on a faster timetable but be expensive. For example, the U.S. government spent more than $30 billion on vaccine development and distribution related to COVID 19 through Operation Warp Speed and related endeavors.[21]

While high-capacity batteries are not yet in broad use given the low penetration of electric vehicles and battery storage, waiting until they become as ubiquitous as semi-conductor chips would likely mean China cements its advantage in battery production that then proves impossible to compete with.

One obvious place to start is recycling of existing materials from lower-capacity batteries that are ubiquitous in cell phones. As the fleet of electric vehicles grows, the potential for recycling materials from those batteries will only grow. The IEA estimates that by 2040 some 10% of the demand for copper, lithium, nickel, and cobalt could come from recycled materials.[22] Whether that percentage is high or low, that still means with rising demand that more minerals will still need to be mined around the world.[23]

That minimally suggests some amount of on-shoring and ally-shoring to source materials for the battery supply chain to diversify away from China. That begs the question about how much Chinese content should be used in U.S. battery systems and whether Chinese investment can be permitted. The Inflation Reduction Act (IRA), which incentivizes domestic battery production for electric vehicles, has strict

[19] Sopcisak 2023.
[20] Davidson et al. 2022, 1268.
[21] Lalani et al. 2023.
[22] International Energy Agency 2021.
[23] Bazilian and Brew 2023.

criteria on local content of minerals and batteries, though how those are implemented has become an increasing source of contestation between the administration and one of the architects of the IRA Senator Joe Manchin of West Virginia.[24]

Davidson et al. worry that overzealous restrictions on Chinese content and investment in the battery and wider cleaner energy space will slow down the clean energy transition because products will not be available at affordable cost, if Chinese exports are abruptly denied entry to the U.S. or priced out of the market through sanctions and penalties. They write: "Too much decoupling will slow technology deployment and the global low-carbon transition" and that "For most technologies, the decoupling 'cure' is likely to be worse than the integration 'disease.'"[25]

They note former Secretary of State Bob Gates' principle of *small yard*, *high fence,* which suggested that the range of goods that the U.S. should restrict from its market on national security grounds (the high fence) ought to be limited to a handful of key areas like telecommunications (the small yard).[26] The risk is that more and more areas of the American economy are potentially seen as strategically off-limits to Chinese imports and/or investments, transforming the American market into a high fence around a large and expanding yard.

In the semiconductors space, this challenge has been dealt with by distinguishing between semiconductors that are necessary for high-end operations and low-end everyday uses, to permit Chinese imports for standard chips used in a range of electronic devices and to limit Chinese threats to, investment in, or exports of high-end capabilities. This is the rationale for trying to deter China from attacking Taiwan where the leading high-end semiconductor facility TSMC is located as well as the CHIPS act which will provide a domestic source of high-end chips should those efforts be unsuccessful. This was also the rationale for the Dutch government's decision not to sell chipmaking "Duv" lithography systems to China.

In the batteries space, while the Department of Defense has discrete needs for batteries that can survive harsh conditions associated with combat, the Department's strategy is premised on the assumption that its purchasing power is small relative to the commercial market and that a proliferation of idiosyncratic DOD-specific custom battery needs means DOD has to pay a premium for batteries and industry has little incentive to them.[27]

The DOD battery strategy, while only available to U.S. government officials and contractors, is summarized in public documents. As one press release noted: "DOD is working to align industry and military battery standards wherever practicable." The release went on to describe the Defense Innovation Unit's Jumpstart for Advanced Battery Standardization: "The program focuses exclusively on

[24] The IRA has a tax credit for new electric vehicles up to $7500. There is a batteries component and a critical minerals requirement. Some EVs may be eligible for all of the credit, while others partial, and still others ineligible. The car has to be assembled in North America. For the battery component, a rising proportion of the battery has to be assembled or manufactured in North America, starting with 50% in 2023. For the critical minerals requirement, a rising proportion of the minerals in the battery, 40% in 2023, has to be extracted or processed in the United States or from a country with which the United States has a free trade agreement. More countries are vying to be included in that list of free trade countries to be eligible for the credit. Parys 2023.
[25] Davidson et al. 2022, 1268.
[26] Sterling, Freifeld, and Alper 2023.
[27] U.S. Department of Defense 2022, 22.

leveraging commercial EV batteries at the module and pack level to inform both the process of integration into military vehicles and the military specifications for electrification of future platforms."[28]

The Administration is using the Defense Production Act (DPA) to enhance domestic production of the battery supply chain.[29] In March 2022, the president invoking the DPA Title III authorities to support critical minerals development for large-capacity batteries. Assistance for Ukraine included $500mn for DPA Title III authorities to expand production of strategic and critical materials. The IRA is said to have an additional $500mn for DPA activities, of which $250mn is available for energy storage, batteries, and strategic and critical materials. The DOD's Industrial Base Office, which administers the DPA Title III program had as of May 2023 $300mn to provide loans, loan guarantees, purchase commitments or purchases, including planned and awarded investments in this space.[30] While the full list of these investments is not publicly available, $37.5mn in DPA Title III support was announced in July 2023. to support the development of Graphite One's development of Alaskan graphite and wider efforts to recycle graphite.

While standardization across the Department and with allies and partner might pool demand, the emphasis is also on making DOD batteries align with private sector standards wherever possible. This perhaps suggests that there will be few DOD-specific batteries, making it difficult to ring-fence a set of high-capacity defense-specific production processes that should be shielded from Chinese imports or investment.

These questions are becoming more urgent as civilian manufacturers seek to meet their needs through licensing agreements like the one between Ford and CATL to build lithium iron phosphate (LFP) batteries in Michigan.[31] That agreement has come under fire from critics who want to limit or exclude Chinese involvement. Other efforts include Chinese battery maker Gotion which is investing $2.3 billion in Michigan to build cathodes and seeking to benefit from the IRA production tax credit for building batteries in the U.S., even as the Chinese content in the batteries makes vehicles built with those cathodes ineligible for the consumer tax credit of the IRA.[32] Another Chinese firm, nickel producer Huayou Cobalt is also seeking to qualify for tax credits by investing in nickel processing in North America and may seek to take advantage of Commerce Department interpretations that suggest less than a 25% share of voting rights by Chinese shareholders might make a firm that makes cathodes in the U.S. (or Mexico in this case) eligible for IRA related tax credits.[33]

Even if the Department of Commerce rules in ways that allow this firm to benefit from IRA incentives, anti-China sentiment in a different administration or in a deteriorating security environment could lead to a reversal of these policies. In the absence of there being defense-specific batteries, regulators should develop some robust decision rules that allow limited Chinese investment and put a premium on technology transfer to U.S. firms. That would at least be a place to start.

[28] U.S. Department of Defense 2023a.
[29] Busby et al. 2023.
[30] U.S. Department of Defense 2023b.
[31] Wayland 2023.
[32] Levine 2023a.
[33] Levine 2023b.

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