June 15, 2022

Bureau of Land Management
Division of Solid Minerals
1849 C Street NW, Room 5645
Washington, DC 20240

Re: Request for Information To Inform Interagency Working Group on Mining Regulations, Laws, and Permitting, DOI-2022-0003

Dear Secretary Haaland, Deputy Secretary Beaudreau, and Deputy Assistant Secretary Feldgus,

We appreciate the opportunity to provide input to the newly formed Interagency Working Group on Federal hardrock mining laws, regulations, and permitting. While new mining will inevitably be part of the transition to a zero-emissions economy, the undersigned organizations firmly believe that material recycling and reuse, along with efficiency and demand reduction, must be vital aspects of the nation's strategy to secure the materials needed for that transition. This comment letter outlines those strategies, which we see not as separate from the conversation about mining reform but instead as part and parcel. Importantly, we affirm that rapidly decarbonizing all sectors of the economy is necessary and urgent, and we reject the notion that transforming our global energy system dooms us to repeat the mistakes of the past, which led to destruction of wild places and harm to communities' health, especially communities of color.

Specifically, we urge the IWG to consider the following:

- **Meeting the nation's critical materials needs can and should not be met by new mining alone.** Given the harmful environmental, social, and cultural impacts of hardrock mining, and given the enormous growth in demand for lithium, cobalt, nickel, and other materials already seen across sectors, the government should work alongside partners to develop a robust materials recycling sector.
- **Reducing the demand for newly mined materials should be a primary goal of this working group.** Strategies to achieve this include creating a circular economy by recycling materials and ensuring products are directed toward useful second-life applications, designing technologies that use less material and use materials more efficiently, continuing and increasing energy efficiency measures across sectors, and creating robust alternatives to single-passenger vehicles, which are expected to become the primary driver of demand for certain minerals in the coming decades.
- **Producer responsibility is essential to creating a successful second-life economy for critical materials.** There are a number of established strategies and solutions that fall under the category of producer responsibility, including collection and recycling programs and product labeling.

- **Critical minerals recycling should have strong guardrails that are appropriate to the impacts of each mineral's unique recycling process.** Due diligence mechanisms need to be implemented and adhered to from the start.
- **Materials recycling and processing will create good, permanent jobs, especially for communities that otherwise might be reliant on boom-and-bust mining.** The IWG can support American worker by requiring fair and just labor practices and standards, including prevailing wage, local hiring especially in low-income and/or historically marginalized communities, and programs to transition displaced fossil fuel workers.

Background

Through EO 14008, "Tackling the Climate Crisis at Home and Abroad" (86 FR 7619), and EO 13985, "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government" (86 FR 7009), the Biden Administration has been proactive in asserting that climate change is an urgent threat, that the federal government can and must act, and that environmental justice is paramount to any action the government takes on climate change. The undersigned organizations agree wholeheartedly. However, as the country accelerates the urgently needed transition to renewable power and electrified transportation and buildings, we must avoid repeating the harm to communities and the environment that resulted from building a fossil-fuel powered economy. It must be acknowledged that the materials needed for batteries, wind turbines, solar panels, and other technologies are derived through extraction which has impacts on communities and the environment, both at home and abroad. Our concerns around the sourcing of critical minerals do not in any way diminish the urgency of the climate crisis and the necessity of the clean energy transition. This transition is an opportunity to choose to do things differently, to incorporate equity in every decision, to think regeneratively about our resources instead of extractively, and to fight for healthy communities, clean air and water, and a healthy climate.

The Biden Administration is also acutely aware of the limitations and challenges surrounding the raw materials needed to make the batteries and other technologies that the clean energy transition relies on. We appreciate the whole-of-government response to this challenge that the Administration has so far put forth, and yet we press the Administration to recognize that a robust circular economy is a vital strategy that will protect lands, waters, and communities, and will also help the country secure the materials it needs. As stated in the June 8, 2021 White House Fact Sheet on the results of the 100-day supply chain assessments put forward in EO 14107[1], "Working together, industry, labor, the government, and other stakeholders can chart a new path forward that emphasizes resilience and security, as well as broad-based growth and tackling the climate crisis." This is true, and yet it is a grave mistake to look only to mining as

[1] https://www.whitehouse.gov/briefing-room/statements-releases/2021/06/08/fact-sheet-biden-harris-administration-announces-supply-chain-disruptions-task-force-to-address-short-term-supply-chain-discontinuities/

the solution to our supply chain challenges. Working together, industry, labor, the government, and other stakeholders can build a strong recycling and reuse sector for clean energy technology, reducing the need for new mining.

The Administration has acknowledged the need for end-of-life reuse and recycling for critical minerals and the technologies they power. In June 2021, the Department of Energy's Federal Consortium for Advanced Batteries released a National Blueprint for Lithium Batteries, which included "enabl[ing] U.S. end-of-life reuse and critical materials recycling at scale and a full competitive value chain in the U.S." as one of five main goals for the Lithium Battery Supply Chain.[2] Additionally, the Bipartisan Infrastructure Law (BIL) included funding to support second-life applications for batteries and battery recycling. These are welcome first steps, but there is much more to be done to ensure a robust circular economy for critical minerals that will lessen our dependence on mining, create good jobs, and steer us toward a clean energy future.

According to the International Energy Agency (IEA) in a special report on critical minerals for the clean energy transition, lithium, nickel, cobalt, manganese, graphite, copper, aluminum, and rare earth elements all play critical roles in clean energy technologies, from batteries to wind turbines to transmission lines. The growing demand for these technologies is already straining or will strain the supply chains for these materials. A typical electric vehicle (EV) requires six times the mineral inputs of a car with an internal combustion engine (ICE), and an onshore wind plant requires nine times more mineral inputs than a gas-fired power plant.[3] The absolute growth in demand for these minerals is uncertain, and largely depends on how well we are able to meet the scale of the challenge in front of us: to achieve climate stabilization "2°C global temperature rise." But even if that ambitious goal is not achieved, automakers estimate that electric vehicles will make up more than half their sales by 2030, in line with the targets the President announced for US EV sales in August, 2021.[4][5] Bloomberg projects around 9.6 million EVs (both BEV and PHEV) will be sold in the US in 2040. Electric vehicles are powered by rechargeable Lithium-ion batteries (LIB), made of different combinations of lithium and other metals including nickel, cobalt, aluminum, manganese, and iron. The impacts of mining these materials are manifold and serious.[6]

Minerals for batteries are of particular concern, both due to the scale of the projected EV market and due to the unique supply chain constraints of common material inputs like cobalt, nickel, and lithium. Batteries make up the vast majority of demand for lithium worldwide, and in 2017 transportation overtook consumer goods as the top end-use for lithium-ion batteries, in

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[2] https://www.energy.gov/sites/default/files/2021-06/FCAB%20National%20Blueprint%20Lithium%20Batteries%200621_0.pdf
[3] https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf
[4] https://home.kpmg/xx/en/home/insights/2021/11/global-automotive-executive-survey-2021.html
[5] https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/
[6] See (other letters?)

terms of energy capacity.[7] Transportation's share of the market is projected to continue to grow, along with energy storage, though this represents a smaller segment of the market. More than half of global cobalt consumption was driven by Li-ion batteries in 2021, with electric vehicles and energy storage systems making up about a quarter of total consumption and expected to grow substantially in the coming years.[8][9] Goldman Sachs forecast a 62% increase in nickel usage for EV batteries in 2022, and another 26% increase in 2023.[10] These figures represent just a few of the many projections from financial institutions, governments, trade associations and companies, all of which echo with the same resounding conclusion: demand for minerals used in batteries is growing, and will continue to grow.

Demand for critical materials is largely expected to outpace supply in the coming decades, even with added mining capacity.[11] A 2020 analysis found that global demand for lithium and cobalt could outpace current production capacity before 2025, and that by 2040 EV batteries could consume as much nickel as total global primary nickel production in 2019.[12] Known reserves for lithium, nickel, and cobalt could be depleted by 2050 if EV sales match the pace needed to meet global climate goals.[13] These projections are only based on light duty vehicles – the electrification of heavy-duty vehicles, and the use of LIB in other sectors like energy storage, will further impact mineral availability. This skyrocketing demand presents risk for workers and communities near mining facilities, the environmental and human health damage from which are well-documented.[14] It also threatens our ability to respond to the climate crisis by delaying the transition to electric vehicles: Transportation accounts for nearly 30% of U.S. greenhouse gas emissions and around a quarter of global emissions.[15][16] We need to diversify our mineral sourcing options, for the sake of communities, the economy, and the planet.

Policy Recommendations

The amount of new material needed to electrify the nation and the world's transportation system depends heavily on a number of factors. These factors include EV battery chemistries and technologies (i.e., how much and what types of materials are used in batteries), fuel efficiency, vehicle weight, vehicle design, battery capacity (i.e. range), socio-economic factors such as

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[7] https://www.interactanalysis.com/lithium-ion-battery-market-poised-for-strong-growth-in-europe-energy-storage-applications-will-be-fastest-growing-sector/
[8] https://www.cruxinvestor.com/articles/the-ultimate-guide-to-the-cobalt-market-2021-2030f
[9] https://www.cobaltinstitute.org/about-cobalt/cobalt-life-cycle/cobalt-use/
[10] https://www.reuters.com/markets/commodities/nickel-demand-boomed-2021-this-year-it-will-be-supply-2022-05-18/
[11] https://www.sciencedirect.com/science/article/pii/S221462962200041X#bb0060
[12] https://www.nature.com/articles/s43246-020-00095-x#MOESM1
[13] id
[14] ?
[15] EPA
[16] https://www.wri.org/insights/everything-you-need-know-about-fastest-growing-source-global-emissions-transport

consumer preference and vehicle price,[17] battery recycling and reuse, transportation alternatives like public transit and micromobility, and more. Each of these factors represents an opportunity for policymaking to steer the clean energy economy towards equity and sustainability.

We support the near- and long-term objectives put forth in the National Blueprint for Lithium Batteries[18] released in June 2021 under Goal #4, "Enable U.S. end-of-life reuse and critical materials recycling at scale and a full competitive value chain in the U.S." The near-term objectives touch on design; collection, sorting, and transport of batteries; and diverting materials for recycling. The long-term objectives are to achieve 90% recycling rates for lithium-ion batteries from consumer goods, EVs, and grid-storage, and to develop policies requiring the use of recycled materials in cell manufacturing materials streams. We also support objectives elsewhere in the report to eliminate cobalt and nickel from Li-ion batteries by funding R&D efforts, and integrating recycled materials into Li-ion supply chains.

Supportive policies and robust funding are necessary to achieve these goals, along with a commitment from the Administration to prioritize this crucial part of the critical materials supply chain. California[19] and the EU[20] have released policy documents outlining steps to address battery sustainability as the clean energy economy grows. Building on these efforts, outlined below are policy recommendations that aim to holistically expand critical materials sourcing beyond primary production, while encouraging reduced demand for critical materials in the first place. These policy actions, taken together, can address short, medium, and long-term issues, and prepare the United States to be a leader in the clean energy economy.

Research, Development & Demonstration

Batteries for energy storage and electric vehicles (the two main sectors projected to drive demand for critical minerals in the coming decades) have improved rapidly since their wide-scale commercial introduction in the 1990s. Average energy density of LIB battery packs increased more than 700% between 2008 and 2020. What's more, battery chemistries have changed: low- or no-cobalt alternative battery chemistries alleviate concerns about cobalt's high costs and price variability,[21] and the human rights and environmental concerns associated with its production.[22] Tesla, for example, used lithium-iron-phosphate (LFP) batteries in half its vehicles manufactured in the first quarter of 2022.[23] And while not yet ready for deployment at scale, batteries using sodium instead of lithium are under development and are expected to enter the

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[17] https://www.nature.com/articles/s43246-020-00095-x#ref-CR5
[18] cite
[19] CA report
[20] Battery regulation
[21] https://www.energy.gov/eere/vehicles/articles/fotw-1228-march-7-2022-cobalt-most-expensive-material-used-lithium-ion
[22] https://www.theguardian.com/global-development/2019/dec/16/apple-and-google-named-in-us-lawsuit-over-congolese-child-cobalt-mining-deaths
[23] https://cleantechnica.com/2022/04/21/half-of-all-teslas-manufactured-in-q1-have-lfp-batteries/

market in a few years, driven by Chinese battery manufacturer CATL.[24][25] There are numerous other battery chemistries on the horizon, and improvements in energy density continue to make EVs cheaper while expanding range. We can reduce mineral demand by increasing battery efficiency, substituting materials, and providing manufacturing and commercialization support for technologies that will help meet these ends.

In its Special Report on The Role of Critical Minerals in Clean Energy Transitions, the IEA notes that historically, substitution and innovation have successfully mitigated mineral supply challenges.[26] The Bipartisan Infrastructure Law (BIL) dedicated billions to battery manufacturing and supply chain improvements. Alongside these investments, the federal government should fund innovation programs like ARPA-E, and support projects with specific goals to reduce materials inputs and study alternative chemistries that can alleviate pressure on supply chains, communities, and the environment. In Europe, the European Commission recently approved a sum of nearly 3 billion Euros to support research and innovation for batteries.[27] The Department of Energy can partner with universities and private companies to make batteries more efficient and less material-intensive, while exploring alternative chemistries that may alleviate the need for new mining capacity.

Given the rapidly changing state of EV batteries in use, the federal government should also avoid over-investing in extraction for materials that may be substituted by other materials in the future. Considerable research should go into understanding the impacts of material substitution, to avoid "regrettable substitution" or simply shifting pollution and/or human rights burdens from one community to another. Similarly, investments made to scale up battery manufacturing now must account for future changes in battery chemistry. A robust domestic battery manufacturing industry that cannot adapt to future battery chemistries locks us into supply chain challenges. As a group of scientists from Oak Ridge National Laboratory note in a recent review, "While a wide range of Co-free cathodes show promise for next generation LIBs, these new materials should be seamlessly upscaled and integrated into existing manufacturing infrastructures… emerging cathode formulations (e.g., DRX systems) will probably require more extensive optimization of the battery assembly process. Systematic R&D efforts are needed to bridge these knowledge gaps and better assess the commercial viability of next-generation cathode systems."[28]

Alongside battery technology innovation, the federal government can support research into alternative extraction practices for Lithium, and support nearby communities in understanding, participating in, and responding to potential activities and impacts. For example, research suggests that the environmental impacts of lithium recovery from geothermal brine are

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[24] https://www.mdpi.com/2079-9292/8/10/1201/htm
[25] https://www.wired.com/story/sodium-batteries-power-new-electric-car/
[26] https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf
[27] https://ec.europa.eu/commission/presscorner/detail/sl/IP_21_226
[28] https://onlinelibrary-wiley-com.proxy.library.ucsb.edu:9443/doi/pdfdirect/10.1002/aenm.202103050

substantially less than from hardrock mining or traditional brine extraction.[29][30] A thorough accounting of environmental, economic, and social impacts should be done before moving new extraction technologies from the lab to commercialization. In line with the comment documents accompanying this one, any extractive operation with environmental and social impacts should comply with the highest standards for environmental and community protection.

Circular Economy

"Circular economy" is a conceptual antidote to the linear economy we currently operate within: as opposed to a make-use-dipose economic model, a circular economy is based on the concept of reduce-reuse-recycle, decoupling economic growth from the extraction of raw materials and consumption of new goods.[31][32] The "reduce" component of a circular economy for clean energy technology corresponds to the previous and subsequent subsections. This subsection focuses on the enormous opportunity for recycling and reusing products and materials to create a closed loop system, while generating good jobs and protecting communities.

The logistics of managing end-of-life recycling and reuse for batteries are complex, and as such the Administration will need to be thorough in setting in place policies along every step of the process to stand up the U.S.' capacity for battery recycling. Batteries must first be removed from vehicles and transported to a recycling facility, and batteries may need to be stored for some time before being transported. Currently, while the infrastructure to collect, sort, and recycle combustion vehicles is well developed, the capacity to collect, sort, disassemble and recycle batteries from EVs is nascent, partly because EVs have not yet begun to reach end-of-life en masse. Most batteries will need to be retired after 10-20 years. In the U.S. new EVs come with warranties for a minimum of 8 years or up to 100,000 miles. In California, the country's largest EV market, 50,000 BEVs and PHEVs were sold in 2014, meaning the batteries in these cars will reach 10 years of use only two years from now.[33] In 2021, more than 600,000 electric vehicles were sold across the U.S.[34] The scale of retired batteries and EVs will ramp up over time as battery capacity depletes. Typically, an EV battery is no longer useful for a vehicle when it is operating at between 70% and 80% capacity, at which point the materials in the battery can be recycled, or the battery itself can be redirected for a second-life application.[35]

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[29] https://pubs.acs.org/doi/full/10.1021/acssuschemeng.0c08733
[30] https://cen.acs.org/articles/95/web/2017/12/greener-way-lithium.html
[31] https://kenniskaarten.hetgroenebrein.nl/en/knowledge-map-circular-economy/what-is-the-definition-a-circular-economy/
[32] https://www.weforum.org/agenda/2020/07/to-build-resilience-to-future-pandemics-and-climate-change-we-must-go-circular/
[33] CA
[34] https://www.energy.gov/energysaver/articles/new-plug-electric-vehicle-sales-united-states-nearly-doubled-2020-2021#:~:text=Energy%20Saver-,New%20Plug%2Din%20Electric%20Vehicle%20Sales%20in%20the%20United%20States,Doubled%20from%202020%20to%202021&text=Sales%20of%20new%20light%2Dduty,2020%20to%20608%2C000%20in%202021.
[35] CA

In the decades to come, demand for critical materials may outpace new mining capacity, underscoring the importance of finding alternative ways to source the raw materials needed for a clean energy transition. Estimates vary on how much recycling will be able to reduce primary demand for minerals, but nevertheless the estimates available suggest recycling makes a significant impact. According to researchers from the University of Technology Sydney, "recycling has the potential to reduce primary demand compared to total demand in 2040, by approximately 25% for lithium, 35% for cobalt and nickel and 55% for copper. This creates an opportunity to significantly reduce the demand for new mining."[36] Researchers at Lawrence Berkeley National Laboratory found that recycling could meet 37%-91% of demand for critical raw materials in clean energy technologies in 2050.[37] Beyond reducing primary material demand, the National Blueprint for Lithium Batteries estimates that using spent lithium-ion batteries to source cobalt and lithium reduces costs by 40%, energy use by 82%, water use by 77% and SOx emissions by 91%.[38] Despite the obvious benefits of increased materials recycling, only about 20% of platinum and cobalt is sourced from recycling, and the rate for secondary sourcing is at 5% or less for most other critical materials.[39]

The BIL dedicated funding to battery recycling and second-life applications in the BIL; however, much more needs to be done to ensure the U.S. is ready and able to process batteries and other technologies as they retire. There are a number of obstacles to creating a robust circular economy for clean energy materials. One is cost: Currently, it is much less expensive to source new material than to collect, sort, and recycle technologies to source secondary materials.[40] Another is design: current battery designs make it difficult to separate lithium, manganese, and copper from other metals, even though all three are technically nearly 100% recyclable.[41][42] Recycling pathways for solar panels and wind turbines are more established.[43] A lack of information on battery composition, collection difficulties, transport hazards, lack of training and infrastructure, low material value, and lack of traceability all present not only challenges, but opportunities for policy making, to spur a domestic recycling industry for critical materials.

As mentioned previously, the EU provides an example of policy leadership on battery recycling. In 2020, the European Commission proposed a new Battery Regulation, which would update and repeal the 2006 Battery Directive. Recently, California released a set of policy recommendations from the Lithium-Ion Car Battery Recycling Advisory Group. The group convened representatives from California government agencies, conservation groups, manufacturers, and others. A report by the Institute for Sustainable Futures prepared for

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[36] Earthworks report
[37] https://www.sciencedirect.com/science/article/pii/S221462962200041X#!
[38] blueprint
[39] https://www.sciencedirect.com/science/article/pii/S2590332221001202#bib28
[40] https://www.sciencedirect.com/science/article/pii/S221462962200041X#!
[41] https://www.sciencedirect.com/science/article/pii/S221462962200041X#bb0310
[42] Earthworks report
[43] https://www.sciencedirect.com/science/article/pii/S221462962200041X#bb0325

Earthworks outlines the policy gaps and enablers for a circular economy for LIB. Building on these three documents, below is a series of policy recommendations aiming to address some of the obstacles discussed above.

Design: Policy to standardize certain aspects of design, or incentivize the implementation of certain design principles, can mitigate the complexity of disassembly for recycling. While lead acid batteries have an impressive recovery and recycling rate, lithium-ion batteries are more challenging due to complex cell designs and chemistries.[44] Design strategies like modular design and design for disassembly, and standardizing design features, enable a more circular economy.[45] A recent study found that design for disassembly strategies can increase recovery and recycling of solar PV systems.[46] Designing technologies with recovery in mind at the outset is not only useful for recycling but also for reuse. For example, designing a battery pack that can be disassembled, tested, and reconfigured for second life can better enable second-life applications in energy storage for EV batteries.[47] Because of the complexity and high variability of LIBs, current recycling processes result in lower-grade material outputs. Disassembly allows for a purer material stream, an important economic consideration in incentivizing better battery design.[48] The BIL included language for grants for RD&D related to "the development of methods to promote the design and production of batteries that take into full account and facilitate the dismantling, reuse, recovery, and recycling of battery components and materials."[49] Research grants can be accompanied by incentives and standards to ensure recyclability across technologies and applications.

Tracking & Labeling: A strong labeling scheme is essential to addressing the high variability in battery chemistries available. LIBs are labeled as hazardous, but lack labeling that would help a handler or recycler identify battery chemistries. This defaults LIB recycling to pyrometallurgy and comminution with hydrometallurgy, because all types of batteries must be dealt with through the same process.[50] This not only leads to higher energy use and environmental impacts from the recycling processes themselves, but also results in lower grade material outputs.[51] Battery labeling would allow for better separation of chemistries, allowing recycling processes to be more tailored and efficient, and enabling recovery of a better product. The BIL authorized funding for the development of voluntary battery labeling standards, and EPA recently released a Request for Information to develop battery labeling standards. In the proposed 2020 EU Battery Regulation, batteries would be required to complete a conformity assessment and be marked as

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[44] https://pubs.rsc.org/en/content/articlehtml/2020/gc/d0gc02745f
[45] https://www.sciencedirect.com/science/article/pii/S2590332221001202#bib105
[46] https://www.sciencedirect.com/science/article/pii/S0921344920304626
[47] https://www.sciencedirect.com/science/article/pii/S2590332221001202#bib113
[48] https://pubs.rsc.org/en/content/articlehtml/2020/gc/d0gc02745f#cit78
[49] IIJA
[50] https://pubs.rsc.org/en/content/articlehtml/2020/gc/d0gc02745f#cit78
[51] https://pubs.rsc.org/en/content/articlehtml/2020/gc/d0gc02745f#cit78

suitable for sale in Europe, in compliance with the Battery Regulation.[52] Starting in 2026, batteries with a capacity greater than 2 kWh would be identified with a "battery passport," a digital tracking and labeling device that communicates battery composition, battery health, and other information like materials sourcing and recycled content.[53] This concept was initially put forth by the Global Battery Alliance, a program of the World Economic Forum. A consortium of carmakers and battery producers has received funding to develop the digital tool.[54] This digital footprint not only enables better sorting and collection, but also aids in tracking, another challenge. Currently there is no accountability for where LIBs end up. China implemented a Battery Traceability Platform to track EV batteries throughout their life cycles.[55] China also enacted a policy in 2018 that requires manufacturers to work with recycling companies to label batteries, and encourage design for recycling.[56] We encourage the administration to consider a mandatory battery labeling and tracking program, with phased in penalties for noncompliance. As the adage goes, "You can't manage what you don't measure." Transparency is an essential tool to keeping materials within a closed loop system, and to retain materials' value by diverting from landfill.

Collection: We were pleased to see a directive establishing best practices battery collection in the BIL. However, the collection of batteries and other clean energy technologies prior to recycling presents a complex set of challenges, and more robust policy should follow the release of the best practices. As the report from California's Lithium-ion Car Battery Recycling Group notes, "These steps are critical to effectively manage batteries, and there is a complex network of actors involved in safely getting the battery from its point of retirement to its next life cycle phase."[57] The report outlines the three main pathways for end-of-life batteries: within dealership and OEM network, outside dealership and OEM network (i.e. private sellers and auctions), and export. While dealership and OEM networks are relatively transparent, there is a great deal of uncertainty in other cases. Export of EV batteries or vehicles themselves in particular presents a challenge in that the U.S. then loses the ability to extract critical minerals from EV batteries. Private sale and auction is largely unregulated, and there is no current federal policy in place that directs where end-of-life batteries or electric vehicles should go after being sold privately or through auction.[58]

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[52] https://www.jdsupra.com/legalnews/new-eu-battery-regulation-additional-1970453/
[53] https://www.jdsupra.com/legalnews/new-eu-battery-regulation-additional-1970453/
[54] https://www.reuters.com/technology/german-funded-consortium-develop-battery-passport-european-batteries-2022-04-25/#:~:text=BERLIN%2C%20April%2025%20(Reuters),economy%20ministry%20said%20on%20Monday.
[55] https://calepa.ca.gov/wp-content/uploads/sites/6/2022/05/2022_AB-2832_Lithium-Ion-Car-Battery-Recycling-Advisory-Goup-Final-Report.pdf
[56] https://calepa.ca.gov/wp-content/uploads/sites/6/2022/05/2022_AB-2832_Lithium-Ion-Car-Battery-Recycling-Advisory-Goup-Final-Report.pdf
[57] https://calepa.ca.gov/wp-content/uploads/sites/6/2022/05/2022_AB-2832_Lithium-Ion-Car-Battery-Recycling-Advisory-Goup-Final-Report.pdf
[58] CA report

One option for improving collection is extended producer responsibility (EPR). EPR is defined as “an environmental policy approach in which a producer’s responsibility for a product is extended to the post-consumer stage of a product’s life cycle” by the OECD. EPR is included in the proposed EU battery regulation, and China also enacted an EPR system in 2017.[59] Some states have also implemented EPR programs for rechargeable batteries and/or electronic waste.[60] The California Lithium-ion Car Battery Recycling Advisory Group Final Report details the components, as well as advantages and disadvantages, of a producer take-back program, as well as a number of other policy proposals to address the challenge of collection for LIB.[61]

Building a Domestic Recycling Industry: The economic case for a circular economy is strong, as demonstrated by the established LIB recycling industry in China. Chinese companies recycling LIB at scale enjoy high profitability, but that is partly due to the high value of nickel and cobalt in NCM and NCA batteries.[62] Policymakers can also bolster the recycling sector through mandates, for example recycled content standards. A recent analysis by Boston Consulting Group concludes, “recycling seems both economically and environmentally sustainable. Recyclers can earn attractive margins, OEMs and cathode manufacturers gain an additional source of materials to feed their supply chains, and recycling the materials generates a smaller carbon footprint than does mining them.”[63] Recycling batteries and other clean energy technologies also creates good jobs. A 2018 analysis found that for every 1000 metric tons of end-of-life LIB, 15 jobs are created.[64] The BCG analysis notes that a number of companies are wading into the battery recycling industry, but that “national labs and government awards may prove instrumental in defining the future landscape of the recycling market.”[65]

Recycled content standards can be an effective tool to stimulate a domestic market for recycled minerals. The 2020 proposed EU Battery Regulation will require “industrial batteries, electric vehicle batteries and automotive batteries with internal storage and a capacity above 2 kWh shall contain a specific percentage of recycled materials. In doing so, batteries shall contain at least 12 % cobalt, 85 % lead, 4 % lithium and 4 % nickel recovered from waste,” with percentages increasing over time.[66] Other strategies include providing tax incentives for new recycling facilities and tax credits for recyclers, expanding the prize for battery recycling

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[59] CA report
[60] Earthworks
[61] https://calepa.ca.gov/wp-content/uploads/sites/6/2022/05/2022_AB-2832_Lithium-Ion-Car-Battery-Recycling-Advisory-Goup-Final-Report.pdf
[62] https://www.bcg.com/publications/2020/case-for-circular-economy-in-electric-vehicle-batteries
[63] https://www.bcg.com/publications/2020/case-for-circular-economy-in-electric-vehicle-batteries
[64] Drabik, E and Rizos, V. Prospects for electric vehicle batteries in a circular economy * CEPS Research Report No. 2018/05. Available: https://circulareconomy.europa.eu/platform/sites/default/files/circular_economy_impacts_batteries_for_evs.p df, 2018
[65] BCG
[66] https://www.jdsupra.com/legalnews/new-eu-battery-regulation-additional-1970453/

authorized in the BIL, and continuing to fund programs like the ReCell Advanced Battery Recycling Center.

It is crucial that any recycling facilities or activities that develop in the U.S. are compliant with strong guardrails and due diligence mechanisms to protect communities and the environment. Recycling processes vary, and some use chemical processes to separate metals in complex products like batteries, and/or high heat processes that require energy inputs. These processes, like any other industrial process, should be strongly regulated and monitored for environmental and social compliance. In addition, community input and approval before the launch of a recycling facility should be required for federally funded projects. Lastly, any facilities or projects receiving federal funding should be required to follow fair and just labor practices and standards, including prevailing wage, local hiring especially in low-income and/or historically marginalized communities, and programs to transition displaced fossil fuel workers.

Second-life Applications: Reuse in second-life applications, namely stationary energy storage, will be part of the circular economy for LIB. Funding for research into second-life applications was included in the BIL. As the authors of a 2021 study note, "LIBs retain a rather high energy storage capacity after their first life in EV, so the resources used for battery production are not fully exploited if they are sent to EOL directly after EV use. However, by reusing automotive LIBs in less demanding second life applications, the recovery and recirculation of valuable metals can be delayed for many years, leading to increasing supply risks."[67] Whether recycling or reuse provides more environmental benefits depends greatly on battery chemistry, and transport and recycling logistics. For example, from a life cycle carbon footprint and environmental impacts perspective, it may be better to reuse LFP batteries in second life applications, while it makes more sense to direct NMC and NCA batteries for recycling.[68] More research should be done to understand the environmental tradeoffs between reuse and recycling, as well as the regulatory and logistical barriers to reuse. For example, a lack of information on battery health, and liability issues for OEMs, might prevent batteries from being used for stationary energy storage in second life.[69]

Energy Efficiency & Demand Reduction

Realistically, given the urgency of the climate crisis and the expected pace of increased demand for clean energy technology, supply chain challenges lie ahead, at least in the next decade. The U.S. will be reliant on imports for at least five to ten years, while new mining capacity and secondary materials resources scale up. A critical but often overlooked aspect of the U.S. critical mineral security strategy should be demand reduction and energy efficiency. While Americans tend to prefer larger vehicles, smaller vehicles will require less material inputs, thereby reducing

[67] https://www.science.org/doi/10.1126/sciadv.abi7633
[68] https://www.science.org/doi/10.1126/sciadv.abi7633
[69] CA report

the strain on supply chains. And while personal vehicle travel is the most convenient form of travel in many cases, improving public transit, electric micromobility (i.e. e-biked and scooters), carpooling and car-sharing, and active transport options helps Americans reduce the need to drive, again alleviating pressure on supply chains. Studies on car sharing in general have proposed that each car shared has the potential to reduce the need for 6–23 private cars in North America.[70] The IWG should work collaboratively with DOT to incorporate the relationship between transportation mode choice, vehicle miles traveled, consumer preference, and critical mineral supply chains into short- and long-term decision making.

Further Resources
We highly recommend the IWG refer to the following documents for more information and policy recommendations:

- "Reducing new mining for electric vehicle battery metals: responsible sourcing through demand reduction strategies and recycling," prepared for Earthworks by the Institute for Sustainable Futures, University of Technology Sydney (April 2021)
- "Lithium-ion Car Battery Recycling Advisory Group Final Report," prepared for CalEPA by Alissa Kendall, Margaret Slattery, and Jessica Dunn of University of California, Davis on behalf of the AB 2832 Advisory Group (March 2022)
- "The Role of Critical World Energy Outlook Special Report Minerals in Clean Energy Transitions," International Energy Agency (May 2021, revised March 2022)
- "Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020," European Commission (October 2020)

Thank you again for the opportunity to provide feedback to the Interagency Working Group. We look forward to continuing to engage with the Administration to create a more sustainable and equitable path to a zero-emissions future.

Sincerely,
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[70] Shaheen, S. A., & Cohen, A. P. (2007). Growth in Worldwide Carsharing: An International Comparison. Transportation Research Record, 1992(1), 81–89. https://doi.org/10.3141/1992-10; & Rydén, C., and E. Morin. Mobility Services for Urban Sustainability: Environmental Assessment. Report WP 6. Trivector Traffic AB, Stockholm, Sweden, January 2005. 213.170.188.3/moses/Downloads/reports/del_6.pdf.