House Energy and Commerce Committee
Subcommittee on Environment
Mint Innovation Testimony
July 16, 2025

Opening Remarks

Thank you Chairman Palmer, Ranking Member Tonko and the Energy and Commerce Subcommittee on Environment for holding today's hearing and elevating the importance around advanced recycling. My name is Matt Bedingfield and I am the Global President at Mint Innovation, a global clean technology company with a mission to localize and decarbonize metal refining. Mint Innovation has been operating since 2016, investing in our proprietary biorefining technology to recover critical metals from end of life electronic assets.

Mint strongly believes that building a robust, circular ecosystem around electronic waste (e-waste) recycling is both an environmental imperative and an economic opportunity. Our mission is to be the world's leading provider of circular green metals. We will achieve this by strengthening domestic infrastructure and capability for responsibly processing e-waste, ensuring that critical and strategic metals remain within our shores to support and secure U.S. manufacturing supply chains.

Mint Innovation has developed innovative technology that combines chemistry and biology to efficiently recover the copper, gold, palladium, silver, tin, lithium, cobalt and nickel from e-waste streams. We offer a sustainable alternative to traditional smelting and informal recycling, both of which are linked to significant environmental and social issues. Our approach delivers local benefits while advancing national priorities in sustainability, security, economic resilience, and clean technology. We recognize that improving recycling rates requires more than technology; it requires trust and transparency. That's why we engage directly with local communities to promote and encourage safe, accessible recycling solutions right here within our borders.

a. Current state of play: The U.S market

E-waste is the world's fastest growing solid waste stream. In 2022, the U.S. alone produced 10% of the world's e-waste, equal to 7.9 million metric tons of e-waste and containing 3.9 million metric tons of metals, such as gold and copper. The economic value of this material is estimated around US$10.6 billion; however, despite the abundance of valuable metals available within this feedstock, the majority of U.S. e-waste is either landfilled or exported often to countries with inadequate environmental and labor protections.

By 2030, projections indicate the global e-waste stream will increase by 32%, reaching 82 million metric tons annually. However, these figures underestimate the impact of emerging digital infrastructure, particularly the exponential growth of artificial intelligence (AI) and data centers. The rapid deployment of generative AI systems, hyperscale data centers, and cloud-based computing is creating a parallel stream of high-performance electronic waste—from graphics processing units (GPUs) and high-density server blades to advanced network modules and semiconductors. A 2024 study published in *Nature Computational Science* estimates that AI-driven data infrastructure could generate between 1.2 and 5 million metric tons of additional e-waste globally by 2030, with the U.S. likely responsible for 20–30% of that total—or up to 1.5 million metric tons annually that is not currently factored into forecasted volumes.

Despite these rising volumes, the U.S. remains unequipped to manage this waste stream at scale. There is no national mandate or federal recycling standard for e-waste. While 25 states and the District of Columbia have implemented e-waste recycling laws, these vary widely in scope, enforcement, and covered devices. This fragmented regulatory landscape leaves critical gaps in

coverage, creates enforcement loopholes, and enables actors to shift operations to states with minimal oversight.

Only 15–20% of e-waste generated in the U.S. is processed through certified recycling channels, and even then, the country lacks vertically integrated infrastructure to collect, dismantle, recover metals, and refine them to market-grade purity. Some domestic firms engage in preliminary shredding or low-grade smelting, but these operations typically stop short of producing high-purity, market-ready materials. Instead, partially processed e-waste is exported for final treatment. In the 2022 year, the U.S. exported an estimated 340,000 metric tons of e-waste, according to the U.S. International Trade Commission. This system results in the loss of critical materials such as gold, palladium, copper, and rare earth elements that are essential to national industries including semiconductors, defense, EVs, and clean energy. It also outsources job creation, technology development, and recycling expertise that could otherwise strengthen the U.S. industrial base.

The majority of e-waste that is not recycled through formal channels ends up in landfills. According to Gutterman (2023), while e-waste constitutes less than 2% of total U.S. landfill mass, it accounts for over two-thirds of the heavy metals found in landfill sites—including lead, mercury, and cadmium. These materials leach into groundwater, contaminate soil, and pose long-term risks to public health and ecosystems.

b. Creating Domestic Supply of Critical Minerals from E-waste for U.S. Manufacturing Supply Chains

The Trump administration's "America First" agenda places a strong focus on the onshoring of U.S. manufacturing as a means to restore industrial strength, safeguard national security, and reduce reliance on foreign supply chains—particularly those tied to China. This strategy emphasized domestic revival

in sectors such as steel, automotive, and electronics, all of which depend on a steady supply of critical and strategic metals.

Today, China controls the global supply chain for many of these essential materials, posing a significant risk to U.S. economic and geopolitical stability. According to the U.S. Geological Survey's 2024 Mineral Commodity Summaries, China is the leading producer of 30 out of 44 minerals. These include metals such as copper, lithium, nickel, tin, and rare earth elements, which are vital for semiconductors, defense systems, electric vehicles, and clean energy infrastructure

The White House has recognized that "processed critical minerals and their derivative products are essential for economic security and resilience because they underpin key industries, drive technological innovation, and support critical infrastructure vital for a modern American economy."[1] President Trump has stated that increasing domestic mineral production, including through advanced recycling technologies, is essential to U.S. national security and economy[2].

To support domestic manufacturing and reduce dependency on foreign supply chains, the U.S. must invest in alternative, onshore sources of refined metals. One of the most immediate and scalable opportunities lies in recovering these materials from e-waste.

Advanced technologies, such as Mint Innovation's proprietary biorefining process, can extract copper, gold, silver, tin, palladium, cobalt, lithium, and nickel directly from printed circuit boards and lithium-ion batteries, producing market-ready metals while generating local industries, adding jobs, reducing emissions, and reinforcing U.S. industrial resilience.

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[1] Ensuring National Security and Economic Resilience Through Section 232 Actions on Processed Critical Minerals and Derivative Products – The White House

[2] Immediate Measures to Increase American Mineral Production – The White House

In line with America First principles, this approach keeps strategic resources and economic value onshore, reduces environmental risk, and accelerates the shift to a secure, circular supply chain for the industries that will define America's future.

c. Comparative Assessment of Options to Increase Domestic E-Waste Processing

The prevailing method for metal recovery from e- waste globally is pyrometallurgical refining, commonly referred to as smelting. While well-established, this technique presents significant barriers to widespread and sustainable deployment within the United States.

- **Extended Development Timelines:** Smelters require extensive timeframes—frequently approaching a decade—from initial design through permitting, construction, and commissioning. This lags behind the pace needed to address rapidly growing e-waste volumes.
- **High Capital and Regulatory Complexity:** Capital expenditure for a single smelting facility typically exceeds US$500-700 million, and permitting is encumbered by rigorous environmental regulations due to air emissions, waste management, and community impact concerns. The perceived and actual risks associated with these facilities often trigger public opposition and regulatory delays.
- **Environmental and Energy Costs:** Pyrometallurgical refining is energy-intensive, contributing to approximately 4% of global energy consumption and responsible for nearly 7% of global greenhouse gas (GHG) emissions. The high-temperature processes required for smelting generate substantial air pollutants and carbon dioxide. In practice, smelting

infrastructure is often centralized and located offshore, resulting in additional emissions associated with the transboundary shipment of hazardous waste materials.

Given these challenges, relying solely on smelters to build domestic recycling capacity will delay progress and undermine environmental goals.

Hydrometallurgy presents a lower-emissions, lower-temperature alternative to smelting that is increasingly being explored for critical and precious metal recovery. Most hydrometallurgy processes use cyanide, strong acids or other chemicals to leach metals from e-waste. Low-concentration metal solutions are produced, which require some form of liquid/solid exchange to recover the precious metal content for further purification. Recycling loops and low-cost product recovery are required for the process to be cost-effective.

d. The Mint's Solution for U.S. E-Waste Recycling

i. Core technology

Mint Innovation is a New Zealand based clean technology company that is working to accelerate our domestic presence through a network of facilities across the U.S. These facilities will process e-waste, like old cell phones or laptops, to recover critical and strategic metals and minerals, including copper and gold, as well as silver, tin and palladium, from printed circuit boards (PCBs).

Mint Innovation is the only commercially scaled hydrometallurgical technology capable of economically recovering valuable metals from printed circuit board waste. Our proprietary biosorption process uses a naturally occurring biomass that is highly selective for specific metals, like high value gold, enabling precise, efficient recovery of high-purity outputs while generating minimal waste. By processing e-waste and producing metals onshore, Mint supports a fully circular

economy—reducing reliance on imported resources and integrating recovered materials back into domestic supply chains.

Each Mint facility is capable of processing up to 8,000 metric tons of PCB and server blade material per year, recovering approximately 1,000 tons of copper, 6 tons of silver, 300 pounds of palladium, 220 tons of tin, and 1 ton of gold. This represents a meaningful domestic contribution to U.S. critical mineral supply security while displacing the need to export hazardous e-waste or rely on carbon-intensive overseas refining. In contrast to traditional pyrometallurgical approaches, Mint's proprietary hydrometallurgical process is conducted at ambient temperatures, produces no air emissions, and requires no combustion or high-temperature inputs. The core of the process is a proprietary biosorption technology that utilizes a naturally occurring biomass with selective affinity for specific metals—particularly gold—enabling precise recovery of high-purity materials while minimizing residual waste.

The facilities are designed to operate within standard industrial zones, using available city infrastructure such as power, water, and wastewater systems. They are rapidly deployable, requiring only 12 months from permitting to operation, and have a relatively low capital cost of approximately US$30 million per site—an order of magnitude less than a single smelter. This modular and distributed model enables Mint to establish a network of strategically located plants across the country, optimizing regional material flows and avoiding overreliance on a centralized processing system. This decentralization not only improves system resilience but also enhances the circularity and security of U.S. metal supply chains.

In terms of operational security, all electronic waste is subjected to size reduction via a hammer mill to a particle size of 0.6 mm or less. This ensures complete destruction of data and chip design, which

is critical for applications involving sensitive or classified information. The process not only increases the surface area for more efficient metal recovery but also provides a high-assurance pathway for secure destruction.

Mint's platform is also being extended to lithium-ion battery recycling, enabling recovery of essential materials such as lithium, cobalt, and nickel from spent batteries using the same low-carbon, low-temperature, closed-loop methodology. A single Mint battery biorefinery is expected to recover 250 tons of lithium, 500 tons of cobalt, and 1,000 tons of nickel per year, directly supporting U.S. battery manufacturing capacity and energy security goals.

The company's services are designed to address the entire e-waste ecosystem—including consumers, recyclers, corporate asset managers, and government agencies. To further improve accessibility and reduce the risks associated with e-waste logistics, Mint is developing a fleet of mobile shredder trucks that can be deployed to secure facilities or corporate campuses for on-site material destruction. These units reduce the chain of custody, limit transportation-related emissions, and enhance trust in secure material handling

e. Benefits to Boosting E-Waste Recycling Infrastructure

In addition to economic benefits, fostering recycling innovation will have several ancillary benefits such as an increase in recycling rates (further increasing economic growth), job creation and environmental impacts.

To truly increase national e-waste recycling rates, we must invest not only in innovative technologies but also in the infrastructure and community partnerships that make recycling accessible and trusted. At Mint, we believe that advancing recycling innovation, building out a distributed processing

network, and proactively engaging local communities are essential pillars of a successful, long-term strategy. Our model emphasizes working hand-in-hand with cities, regional leaders, and community stakeholders to promote safe, visible, and convenient recycling solutions—right here within our borders. By locating our facilities within urban industrial zones and ensuring they are publicly acceptable and environmentally responsible, we foster community trust and participation.

Each of our U.S. facilities will contribute directly to local economic development. On average, a single Mint facility will create 35 high-quality, family-sustaining direct jobs, and support an estimated 121 additional indirect jobs in adjacent sectors such as logistics, equipment services, utilities, and downstream manufacturing. These are skilled, clean economy jobs that support long-term workforce development in host communities.

The environmental benefits of scaling technologies like Mint's are also compelling. According to analysis by the REMADE Institute, if the U.S. were to increase recycling rates by just 20% using less energy-intensive technologies like ours, the country could reduce energy consumption by 21 petajoules and avoid 1.2 million metric tons of CO_2-equivalent emissions each year. These savings would represent a major step forward in achieving national climate targets while bolstering domestic supply chains for critical and strategic metals.

f. Policy recommendations

Mint commends the Subcommittee for recognizing the need to modernize recycling policies and expand the federal government's role in advancing new recycling technologies. Mint Innovation has developed the following recommendations to ensure this:

- First, we encourage the federal government to work across agencies through the Department of Energy, Environmental Protection Agency, and Department of Defense to invest in new

recycling technology that supports a circular economy domestically and taps into valuable resources that exist within current waste streams already within our country's borders. Federal support to mobilize interagency collaboration on advancing recycling efforts domestically will allow companies like Mint Innovation to expand rapidly.

- Second, a critical barrier to effective e-waste recycling is public awareness. Many Americans do not know what they can and cannot recycle. This leads to the improper disposal into landfills or storage of electronics at home. We encourage the Environmental Protection Agency to work with states to develop educational campaigns to inform consumers and businesses about the importance of properly recycling e-waste. Expanding awareness across all regions—especially underserved and rural communities—will significantly increase participation in recycling programs, reduce environmental harm, and support the growth of domestic recovery industries like Mint Innovation.

- Third, while the United States generates a significant amount of e-waste streams annually, a large portion of it is exported out of the U.S. to foreign countries. This contributes to national security risks and undermines the development of the critical material recovery industry. The federal government should enforce penalties to curb the exportation of e-waste.

- Lastly, Mint commends policymakers like Representative Haley Stevens for continuing to champion legislation like the *Unearth America's Future Act*. This bill represents a critical step toward directing federal investment—through loans and tax credits—to accelerate domestic mineral production and advanced recycling. Congressional focus on strengthening U.S. supply chain independence and supporting domestic industries creates the conditions for innovative companies like Mint to grow and thrive. This includes efforts made by a number

of Members in both the House and Senate who are currently working to pass the *Critical Minerals Consistency Act*, which aligns DOE and USGS's critical minerals list to include copper. We strongly encourage continued bipartisan efforts to advance policies that provide targeted federal support for private-sector solutions, enabling companies like Mint to expand critical metals recovery infrastructure and help build a resilient, circular economy here at home.

Closing Remarks

In closing, I want to thank the committee for inviting Mint Innovation to be a part of today's important conversation. Mint stands eager to work with Congress, federal agencies, and the Administration to build the infrastructure needed to transform e-waste into secure, sustainable domestic supply chains of critical materials.

Thank you and I look forward to your questions.