

Committee on Natural Resources, Subcommittee on Energy and Mineral Resources

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“Deep Dive: Examining the Regulatory and Statutory Barriers to Deep Sea Mining”

Responses to Questions for the Record from Mr. Oliver Gunasekara, CEO and Co-Founder, Impossible Metals Inc.

Questions from Rep. Fulcher

1. What barriers currently exist to constructing a processing facility for deep-sea mining?

Several significant barriers currently impede the construction of domestic processing facilities for deep-sea minerals:

First, the United States currently lacks domestic processing capability for the critical minerals found in polymetallic nodules. The expertise and workforce for mineral processing have largely migrated overseas, particularly to China, which now controls 78% of refined cobalt, 95% of refined manganese, 35% of refined nickel, and 45% of refined copper globally. Rebuilding this knowledge base and training a qualified workforce will require targeted investment and time.

Second, capital costs for processing facilities are substantial, and private investors face uncertainty about the timing and scale of nodule supply. Without a reliable feedstock of nodules from permitted mining operations, investments in processing facilities carry risk.

Third, permitting industrial processing facilities faces its own regulatory challenges, including environmental reviews and community engagement requirements that can extend timelines.

To address these barriers, Impossible Metals recommends a phased approach: (1) stockpile nodules in U.S. locations with good transport logistics and energy access; (2) initially partner with existing nickel processing facilities in allied nations like Japan, Australia, and Canada, which can be retrofitted to process nodules; and (3) develop new bespoke processing facilities in the United States adjacent to these stockpiles. The U.S. government can accelerate domestic processing capacity through stockpiling through Project Vault or the National Defense Stockpile to stimulate demand, direct investments to processing entities under existing Defense Production Act authorities, provide innovation grants for technologies that can efficiently refine multiple metals from seabed minerals, and consider trade agreements with allies that have relevant facilities.

2. What do you believe is the most acute need as the US moves to establish deep-sea mining?

The greatest need is regulatory certainty and predictable timelines for leasing and permitting. Companies like Impossible Metals are prepared to invest billions in developing this new industry, but private capital requires confidence that permits will be issued on reasonable timelines and that granted permits will be honored.

President Trump's Executive Order on Unleashing America's Offshore Critical Minerals was a crucial first step, triggering action at BOEM and NOAA on leasing, mapping, and exploration. However, Congress should now strengthen the statutory framework by:

- Establishing predictable statutory timelines for each stage of the leasing process, with clear consequences for missed deadlines;

- Streamlining and clarifying the permitting process, which currently involves six comment periods before commercial collection can begin under BOEM's OCSLA regulations;
- Strengthening the certainty of granted permits so that companies have confidence their investment will be protected from political interference; and
- Matching lease terms under OCSLA and DSHMRA to international standards. The proposed ISA contract length is 30 years with potential extensions, while U.S. law provides 20-year terms. American companies should not be disadvantaged compared to foreign competitors.
- Codify the EO, ensuring that the nation's commitment to seabed minerals endures across administrations.

Questions from Rep. King-Hinds

1. Why have you expressed interest in mining in the waters offshore the Pacific territories and not the Blake Plateau offshore Georgia and South Carolina, where there are also known deposits of minerals and where scientists are still observing the effects of mining tests conducted 50 years ago?

Impossible Metals' focus on the Pacific is driven by the specific characteristics and presence of polymetallic nodules, which are our exclusive area of technological focus.

The Pacific Ocean, particularly areas like the Clarion-Clipperton Zone and the waters near American Samoa and the Cook Islands, contains some of the world's richest known concentrations of polymetallic nodules and has seen the most significant research and exploration activity over the past several decades. The Clarion-Clipperton Zone is estimated to contain 21.1 billion tons of polymetallic nodules, according to the USGS. The Cook Islands' EEZ is estimated to contain 12 billion tons of critical minerals. The U.S. EEZ 130–305 miles off the coast of American Samoa is adjacent to the Cook Islands and is believed to have rich deposits of these nodules.

The Blake Plateau contains different types of mineral deposits, including phosphorite nodules and ferromanganese crusts, each with its own characteristics, and would require different collection technologies. The polymetallic nodules in this area are also not believed to be as economically valuable as those in known Pacific areas, given their geology (higher iron concentration) and prevalence.

2. Would you support (in principle) legislation that would require the federal government to share revenues from offshore mining operations with local coastal jurisdictions like the CNMI, similar to the revenue sharing arrangements already established under law for Gulf states under the Gulf of Mexico Energy Security Act, also known as GOMESA?

Yes, Impossible Metals strongly supports extending revenue sharing to coastal communities. In my written testimony and in a recent article on our website entitled "[Smart Stewardship: Extending State/Territory Revenue-Sharing to Marine Minerals](#)" (August 2025), I called on Congress to apply the precedent set by the Gulf of Mexico Energy Security Act of 2006 to deep-sea mining. Under GOMESA, a portion of royalties from offshore oil and gas leases in federal waters flows to neighboring Gulf Coast states, building public trust and funding coastal resilience projects.

The same principle should apply to deep-sea mining. Additionally, Impossible Metals has voluntarily committed to dedicating 1% of our profits from marine mineral collection in the American Samoa U.S. EEZ lease area to benefit the local community, should we be awarded that lease. Deep-sea mining offers valuable employment and investment opportunities for Pacific Island communities, and we are committed to building something lasting in partnership with them.

3. If awarded a lease for the CNMI RFI area, do you plan to apply for additional mining rights in adjacent areas outside the EEZ in international waters?

Impossible Metals is pursuing multiple paths to access seabed mineral resources and remains open to opportunities in both U.S. and international waters where appropriate regulatory frameworks exist. We have not yet decided whether to pursue a lease in the CNMI RFI area, and the Administration has not yet announced whether they will hold a lease sale in this area. Additional mapping, resource estimation, and other research are needed.

In international waters, we have already taken steps to access an area for exploration of polymetallic nodules. Our subsidiary, sponsored by the Kingdom of Bahrain with the support of the U.S. State Department, has applied to the International Seabed Authority for an exploration license in the Clarion-Clipperton Zone. This application covers a resource area of 75,000 square kilometers containing polymetallic nodules with high grades of critical metals. The application will be considered at an upcoming ISA meeting.

Any future decisions regarding additional applications depend on the status of our current applications; the regulatory environment; the geology, environmental status, and economics of a particular area; as well as our operational capacity.

Questions from Rep. Moylan

1. In what countries, States, and/or U.S. Territories is Impossible Metals planning to process the nodules it collects from the Pacific Ocean?

Impossible Metals plans to partner with other entities to process nodules. We do not plan to build or own processing plants ourselves.

The location of partner processing facilities has not yet been determined. Still, there are significant advantages in supply chain security, end-customer proximity, and logistics to processing in the mainland United States. While the capacity does not yet exist, Impossible Metals has signed Memoranda of Understanding with two U.S. companies, ReElement Technologies and Aqua Metals, to explore innovative, low-environmental impact processing approaches in the U.S.

2. Does Impossible Metals believe that, with current technologies, islands like Guam could become centers for critical minerals processing/refinement?

Mineral processing facilities require significant infrastructure, including deep-water port access, affordable and reliable energy supply, water resources, workforce capacity, and geographic proximity to feedstocks and end customers. While Guam has strategic geographic advantages in the Pacific, including potential nearby mineral resources, the island would need to be evaluated against these criteria. Traditional mineral processing technology is unlikely to be practical in Pacific islands, but innovations may make it feasible, such as biorefining techniques

that harness naturally occurring bacteria that breathe ore and extract metals with minimal energy input and no toxic waste.

3. If Impossible Metals does not plan to invest in refinement centers in Guam or the other U.S. Territories, what is the actual economic benefit of deep-sea mining for territorial communities? How many jobs would Impossible Metals create in territorial communities and what is the salary range for those employees?

Deep-sea mining could create multiple categories of economic benefits for territorial communities:

- *Direct Employment Opportunities:* Local provisioning of ship operations and crew, emergency and standby vessel support, port facility utilization, environmental monitoring, onshore equipment testing and maintenance, and administrative and logistics support.
- *Academic Research Opportunities:* Substantial scientific and academic research will be required in each mining area to establish a baseline, understand impacts, and leverage the rich new knowledge available about previously unexplored regions. This is an opportunity to establish new academic and scientific research facilities that will offer highly-skilled jobs.
- *Revenue Sharing:* Impossible Metals supports GOMESA-style revenue sharing of offshore royalties for coastal communities, and we would be pleased to work with you and Congress to advance this policy. Companies should also consider voluntary investments and donations to the local community, as Impossible Metal has committed to in American Samoa.
- *Economic Multiplier Effects:* Support services, hospitality for rotating crews, supply chain opportunities, and infrastructure investments that benefit the broader economy.

Specific job numbers and salary ranges depend on the scale of operations and specific arrangements with each territory. We have not yet determined whether we will seek a lease in the CNMI RFI area that includes Guam, and the Administration has not yet determined whether a lease sale will take place in this area. Additional mapping, resource estimation, and other research are needed. We would be pleased to stay in touch as our project plans advance.

For a broader context, the Trump Administration has estimated that deep-sea mining could generate \$300 billion in U.S. economic output and create 100,000 domestic jobs over the next decade industry-wide.

4. Using your best estimates, what would be the timelines for TMC or Impossible Metals to actually stand up commercial-scale operations in the Pacific and how long would it take for these to be profitable?

For Impossible Metals, subject to receiving regulatory approvals, we expect to begin production within three years.

Regarding profitability, our published economic model (version 7) shows that a deep-sea mining project using Impossible Metals' technology at scale would generate approximately \$4 billion in revenue and around \$1 billion in profit per year at scale. Our model projects the first project to be profitable by the third year of production.

5. Mr. Gunasekara, in our conversation earlier you talked about how your company's underwater robots use "pick and place" arms that will minimize sediment and ecosystem

disturbance. According to your website, Impossible Metals began working on the Eureka Collection System in 2020 and has done two demos—both in Lake Huron and two ocean demonstrations. Has your company ever tested the system in the Pacific Ocean or at any substantial test scale?

Our technology has been tested in the ocean at depths of over a mile, demonstrating our core capabilities, including the buoyancy engine, AI-driven nodule identification, and robotic arm collection. We have conducted ocean deployments and released public data from these tests.

We have extensive testing facilities in our robotics lab and typically conduct lake testing every few weeks, with deep-ocean testing as required.

The final test for regulatory approval will take place in 2026 with our full-scale collector robot, Eureka III. Impossible Metals is collaborating with BGR (Germany's Federal Institute for Geosciences and Natural Resources) to test our hovering selective harvesting robot in the Clarion-Clipperton Zone in the Pacific Ocean. This test will validate our sediment modeling and demonstrate our environmental performance at depth. The exploration leasing process will enable further data collection.

6. If Impossible Metals have not yet tested its Eureka system at scale or in real Pacific Ocean environments, what reassurance can you give that Impossible Metals' collection systems will be less disruptive than something like The Metals Company's seabed collectors that use the Coanda effect?

The fundamental physics and engineering of our approach provide strong reassurance, which will be validated through our upcoming tests in the CCZ.

Our robots hover above the seafloor without landing or driving across the sediment, use robotic arms to pick up nodules individually rather than scooping or vacuuming, have buoyancy engines that make the robot positively buoyant (meaning thrusters push upward, not downward into sediment), and eliminate the need for a riser pump system and its associated discharge plume.

Independent modeling by DHI Water and Environment found that the expected sediment disturbance of our production-scale device, Eureka III, is approximately 46 kg/hour. For comparison, the GSR Patania II, which uses traditional dredging technology, produced a sediment discharge rate of 52,500-56,000 kg/hour.

We are committed to validating this modeling through live testing and to transparency about the results. If our system does not perform as modeled, we will adapt our approach. Our entire company was founded on the premise of creating the most environmentally responsible form of mining possible.

7. Mr. Gunasekara, in a December 2025 article by Anita Hofschneider from Grist, you are quoted saying, "My understanding is that the intangible cultural connections have died down because most of the specific communities are Christian, and so these are beliefs that really predate Christian activities, and so as the communities adopted Christianity, some of the historic spiritual connections have diminished." This statement seems to draw a stark contrast between how you view Pacific Islander cultural connections to the ocean and the First Nations cultural connection to lands in Canada, which you recognize in the land acknowledgements featured at the beginning of Impossible Metals's presentations on Demo Day 2023 and 2024. This has notably caused some friction among CHamoru and Refaluwasch cultural advocates, who have voiced that our connection with the waters is not severed by our Christian faith. Would you mind elaborating on your

comment in Grist and responding to the concerns raised by cultural advocates in the Marianas?

I appreciate that the CHamoru and Refaluwasch communities have deep, living cultural connections to the ocean that are not diminished by their Christian faith, and that many Christians of all communities have strong ties to their environment. As I noted in my remarks to Grist, "People have a spiritual connection to the ocean, and we have to respect their beliefs." Impossible Metals is committed to engaging respectfully with all communities whose waters may be affected by deep-sea mining activities, including listening to their concerns.

I would welcome the opportunity to meet directly with cultural advocates in the Marianas to hear their perspectives, answer their questions about our plans or technology, and discuss how Impossible Metals can approach our work in a way that respects and honors their cultural connections to the ocean.

8. Guam's unified response to deep sea mining has a common underlying current across every resolution, petition, and letter: the actions taken so far have been without the prior consultation or consent of our people. How is Impossible Metals engaging local communities in Guam, the Northern Mariana Islands, and American Samoa about deep sea mining?

Community engagement is a vital part of responsible resource development, and we recognize that Pacific Island communities have historically seen opportunities that did not endure or live up to their potential. We are committed to building something lasting, in partnership with these communities.

Our community engagement to date has focused on American Samoa, where we requested that the Department of the Interior begin the process of a potential lease sale in an area 130–305 miles off the coast of American Samoa. Our activities have included presenting to the Regional Ecosystem Advisory Committee, participating in town halls and local media interviews, meeting with governmental officials and other leaders, and making informational materials publicly available. These processes are in the early stages, and we plan to increase our local engagement as the multi-year lease sale process progresses.

In Guam and the Northern Mariana Islands, we submitted public comments on the Administration's Request for Information to provide additional information and an industry perspective. We welcome the RFI because it initiated a vital public dialogue, as communities consider this new industry. As noted above, we have not made any decisions regarding exploration or activities in this area, and the Administration has not announced any decisions about whether a lease sale will take place.

We believe that communities should have meaningful opportunities to provide input before decisions are made. We support robust public comment periods as part of the Environmental Impact Assessment process, which is required before any mining can commence. We are committed to transparency about our plans and technology, and we welcome the opportunity to expand our engagement with communities in Guam, the Northern Mariana Islands, and American Samoa.

9. In your opening testimony, you mentioned that the People's Republic of China's (PRC's) technology simply vacuums the sea floor and is environmentally damaging. This statement seems to indicate that similar technologies using the Coanda effect or vacuums are also environmentally damaging. What, if any, meaningful difference exists between the PRC's technology and the system proposed by The Metals Company? Why

should the people of Guam or any other district in the U.S. feel more comfortable with an American vacuum system over the same technologies used by the PRC?

If America leads the world and sets the rules for deep-sea mining, then American values will govern this industry. Regulators can set a high bar for environmental responsibility based on science, and companies will innovate and compete to meet it. The PRC's advocacy at the International Seabed has reportedly included efforts to weaken environmental safeguards or inspection requirements, while America has a robust environmental legal system under domestic law.

10. Throughout the hearing, we discussed the risk of mining critical minerals on land, particularly the fact that it can and has permanently damaged and significantly disrupted ecosystems. By simply moving critical mineral mining operations underwater, are we just hiding the environmental problems in another ecosystem?

First, we must recognize that the demand for critical minerals is essential and growing. The World Bank projects a 450% increase in demand for minerals like cobalt and nickel by 2050. Without new sources, this demand will be met through expanded land-based mining, with all its associated environmental and human costs; a shrinking economy; and rising temperatures that pose an existential threat to ocean ecosystems.

Second, not all ecosystems are equivalent in terms of biomass and biodiversity. The deep-sea abyssal plains where nodules are found have far less biomass than terrestrial ecosystems. Rainforests have up to 3,000 times greater biomass than the seafloor, where life is scarce and largely microscopic. No humans live near deep-sea mining sites. In stark contrast, mining directly impacts human communities and rich biodiversity in Indonesian rainforests (where 75% of nickel now comes from) and the DRC (where 70% of cobalt originates)..

Third, and most importantly, technology matters. Impossible Metals was explicitly founded to develop a mining method that preserves existing deep-sea ecosystems. By leaving approximately 90% of nodules undisturbed, avoiding visible marine life, and minimizing sediment disturbance, our approach is fundamentally different from traditional mining. American innovation can create a lower-cost, lower-impact alternative to the Chinese-controlled, environmentally devastating sources that much of the world relies on today.

11. During the hearing, Mr. Huffman brought up an important point: the U.S. is not a party to the UN Convention on the Law of the Sea (UNCLOS) or a full member of the International Seabed Authority (ISA). Effectively, this means that we are outside of the international permitting regime for deep sea mining. The PRC has, in the past, simply utilized their distant water fishing fleet and other state subsidized or owned vessels to force other nations out of areas that the PRC is interested in controlling. Without sole-jurisdiction permitting from the ISA or the signatory guarantees of UNCLOS, we would have no recourse in the international systems to fight those actions if they were to occur. If the U.S. were to issue leases in waters beyond national jurisdiction, what would ensure that we would have sole access to those spaces?

The U.S. has longstanding domestic legislation, the Deep Seabed Hard Mineral Resources Act (DSHMRA), that authorizes U.S. companies to operate in international waters. This law was enacted in 1980 because the United States felt it did not need to wait for global consensus to secure its own mineral future. Two DSHMRA licenses were issued decades ago and remain active.

While the U.S. is not a party to UNCLOS, it has significant tools to protect American interests in international waters. The U.S. Navy is the world's most powerful, and the United States regularly conducts freedom-of-navigation operations globally.

The original DSHMRA rules provided that U.S. government officials should use their good offices to assist American companies if a foreign-sponsored applicant received a conflicting permit for the same area. This provision has sunset, and I recommended in my testimony that Congress resurrect a version of this assurance to provide companies with vital confidence.

Finally, Impossible Metals is pursuing access through the ISA system via our Kingdom of Bahrain-sponsored application, which provides international recognition. We continue to study the DSHMRA process, but renewed attention to its provisions has already proven essential for global progress on deep-sea mining regulation, especially given the historic delays at the ISA in adopting a commercial mining code for decades.

Questions from Rep. Huffman

1. In your testimony, you stated that deep sea mining could create “300 billion in domestic economic output and more than 100,000 jobs over the next decade”. Please elaborate on the source of those figures and where and on what timeframe the jobs and economic output are anticipated to occur.

These figures were cited in multiple media reports as Administration estimates associated with President Trump's Executive Order on Unleashing America's Offshore Critical Minerals, as the economic output that could be produced over the coming ten years. I referenced them in my testimony as representing the potential scale of the opportunity if the United States moves decisively.

For context on potential scale, Impossible Metals' published economic model (version 7) projects that a single project at scale using our technology could generate approximately \$4 billion in annual revenue. The total market for the four metals found in polymetallic nodules (copper, nickel, cobalt, and manganese) is approximately \$450 billion per year in 2025 and projected to reach \$650 billion by 2030.

2. Please provide a dated list of all meetings you have had with BOEM or other federal agencies regarding deep sea mining and the topics discussed.

As appropriate, we have engaged with BOEM, NOAA, the State Department, and other relevant agencies since 2023 — under both President Biden and President Trump's administrations — to ensure relevant officials were fully apprised of our plans and how developments in this technology might inform the various regulatory processes underway.

3. Have you communicated to NOAA, BOEM, or another federal agency, formally or informally, additional priority areas for mapping of seabed resources outside of your leasing application?

No.

In your testimony, "you called for Congress to direct the National Defense Stockpile to include deep-sea nodules procured from American waters and nodule-derived minerals." Can you explain why this sort of "market-making mechanism" is necessary given current and projected market demand for these minerals?

An important role for the government is to accelerate the growth of strategic new industries that must bridge the “valley of death” from technology demonstration to scaled production. There is

both a clear and present need for critical mineral security — as we have seen with China’s repeated weaponization of their resource control over the United States and key allies like Japan — and ample precedent for doing so. For example, the Federal government provided decades of direct subsidies to solar and wind generation technologies, despite an ample current and projected market demand for electricity, due to policymakers’ view of those industries’ national strategic value and the national interest to increase production scale and efficiency.

Market-based mechanisms are cost-effective, technology-neutral, and potentially even profitable for the taxpayer, particularly compared to direct subsidies. Market-making mechanisms like stockpiling have several benefits to the public:

- First, and most fundamentally, a stockpile creates a strategic reserve of metals critical for national security. Nodules degrade more slowly than processed metals, making them well-suited for long-term storage.
- Second, stockpiling provides a demand signal that allows private capital to take the risks of ship retrofits, robot manufacturing, and mineral collection before commercial markets are fully developed. This is a classic challenge for any new industry, particularly those that are hardware- and thus capital-intensive.
- Third, a domestic stockpile incentivizes the construction of domestic processing facilities adjacent to the stockpiles, building out the infrastructure America needs for long-term mineral security.
- Finally, unlike direct subsidies, a stockpile is a market-making mechanism that, under government supervision, provides an opportunity for the taxpayer to recoup or even profit from as metal prices rise. The metals retain their value.