

DOCKETED

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**Strengthening Critical Materials Supply Chains Through Domestic
Phytomining of Nickel**

Additional submitted attachment is included below.

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Domestic Critical-Minerals Innovation — Phytomining for Nickel

June 18, 2026

California Energy Commission

Dockets Office, MS-4

1516 Ninth Street, Sacramento, CA 95814

Submitted via the EPIC 5 e-comment system, Docket No. 25-EPIC-01

Re: Docket No. 25-EPIC-01 — Comments on the Draft EPIC 5 (2026–2030) Investment Plan: Strengthening Critical Materials Supply Chains Through Domestic Phytomining of Nickel

Dear Commissioners and EPIC 5 Staff:

Bellus Ventures II Management Co LLC (“Bellus”) respectfully submits these comments on the draft EPIC 5 strategic initiatives and research topics presented at the June 11, 2026 public workshop. Bellus is developing nickel **phytomining** — a plant-based method of producing domestically sourced nickel, a critical mineral for batteries and grid-scale storage — for the clean-energy supply chain. We write in **strong support** of the proposed initiative “Enhancing Clean Energy Technology Safety, Supply Chains, and Life Cycle Benefits,” and in particular its research topic “Strengthening Critical Materials Supply Chains for Clean Energy Technologies.” We respectfully urge the Commission to retain this topic in the EPIC 5 Investment Plan and to **ensure its scope expressly contemplates domestic, in-state processing of critical minerals, including from emerging plant-based sources**. As a secondary matter, we note that phytomining also intersects several other draft topics, and we encourage the Commission to keep solicitation scopes broad enough to admit it on its merits.

What is Phytomining?

Certain plants, known as hyperaccumulators, naturally draw metals out of the soil through their roots and concentrate them in their above-ground tissues. Phytomining grows these plants on metal-bearing soils — typically serpentine and of marginal conventional agricultural value — harvests the biomass, and processes the metal-rich material into saleable mineral products. In effect, the plant acts as a solar-powered pump that gathers diffuse nickel from the ground and concentrates it into a feedstock that can be refined using conventional hydrometallurgical chemistry.

Bellus has focused its research on *Streptanthus polygaloides*, a nickel hyperaccumulator native to the Sierra Nevada foothills of California. This choice is deliberate and consequential: earlier U.S. efforts relied on a foreign hyperaccumulator species that proved invasive, ecologically damaging, and unsuitable for deployment in California. Using a California-native hyperaccumulator species aligns phytomining technology with the State’s ecological and regulatory priorities.

Early-stage laboratory research on the pathway has been supported federally through the U.S. Department of Energy’s ARPA-E PHYTOMINES program, under which the University of Florida — a publicly documented research collaborator — received a \$1.9 million award titled “Nickel Farming: Improving a U.S.-native Hyperaccumulator Plant for Commercial Cultivation.” East Bay

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Municipal Utility District (EBMUD) has supported field research by making available land in California for field trials. The first-of-a-kind scale-up and processing needed to bring the pathway to ratepayer-relevant scale — in particular, **converting the nickel-bearing residue into battery-grade product — remains unfunded**, and is the gap on which these comments focus.

The Pathway Directly Addresses the Initiative's Stated Challenge

The initiative's stated challenge — that gaps in the domestic supply chain for critical materials, together with expensive recycling strategies, slow the affordable deployment of clean energy — describes precisely the problem phytomining addresses. Nickel is a designated critical mineral on the USGS Final 2025 List of Critical Minerals and a critical material for energy, driven chiefly by demand for batteries and grid-scale energy storage. The United States today imports the large majority of its refined nickel — reportedly on the order of 90 percent — with global battery-material refining heavily concentrated overseas, and the last operating U.S. nickel mine was reported to be closing in 2026. A low-impact, in-state source of nickel therefore speaks directly to the supply-chain resilience and affordability concerns this initiative was created to solve.

Consistent with EPIC's foundational rationale of funding public-interest research where private capital is unlikely to provide adequate support (CPUC Decision 12-05-037), EPIC support here would complement rather than duplicate other investment. Federal research funding has supported early-stage laboratory work, and recent federal critical-materials funding has focused broadly on processing, battery manufacturing, and recycling. The first-of-a-kind scale-up and processing of phytomining-derived, nickel-bearing residue into battery-grade product remains a distinct gap that neither stream squarely addresses, and one that private capital has been hesitant to finance alone at demonstration scale — the catalytic, public-interest role EPIC was designed to play.

Alignment with EPIC's Ratepayer-Benefit Mandate

EPIC investments must deliver benefits to electricity ratepayers in the form of safe, affordable, reliable, equitable, and environmentally sustainable energy. A domestic critical-minerals pathway advances each:

- **Affordability.** Grid-scale storage is increasingly central to a reliable, affordable clean grid, and nickel is a primary cost driver of battery cathodes. A domestic, in-state nickel source can diversify supply and reduce exposure to import dependence and price volatility — directly supporting the initiative's stated benefit of lowering the cost of energy storage on the grid.
- **Reliability and resilience.** Strengthening the domestic critical-materials supply chain that underpins energy storage reduces the risk of supply disruptions that can raise costs and delay the storage deployments needed to limit grid outages and interruptions.
- **Equity.** Phytomining will be sited on serpentine rural land that has little agricultural value. Project siting can advance EPIC's minimum funding allocations for disadvantaged and low-income communities and deliver economic and resilience benefits to rural and tribal

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communities, consistent with the initiative's stated benefit of improving outcomes for disadvantaged and vulnerable communities and tribes.

- **Environmental sustainability and life-cycle benefits.** Phytomining offers soil-remediation co-benefits and siting on marginal land minimizes food-versus-fuel competition. Nickel derived from phytomining will have a lower life-cycle footprint than conventional mined nickel.
- **Safety.** Proactive research on the emissions behavior of metal-bearing biomass during thermal conversion, and on safe handling and processing of the nickel-bearing residue, will ensure the pathway is engineered from the outset to protect local air quality and host-community health.

Support for the EPIC 5 Strategic Goals

The pathway also supports the EPIC 5 Strategic Goals:

- **Transportation Electrification and Distributed Energy Resource Integration.** Nickel is a core input to the battery cathodes that power electric vehicles and the storage systems that integrate distributed renewables; securing a domestic source helps underpin the material base both goals rely on.
- **Getting to 100 Percent Net-Zero Carbon.** Decarbonizing the grid is, in large part, a materials challenge: a low-impact, in-state nickel source helps ensure the storage and electrification needed for a net-zero system are not bottlenecked by imported, higher-footprint material.
- **Climate Adaptation.** Producing nickel by phytomining on marginal land carries a lighter environmental footprint than conventional hard-rock or laterite mining, and an in-state supply is less exposed to the climate- and geopolitics-driven disruptions that threaten import-dependent supply chains.

Summary of Recommendations

The activities below span all three EPIC funding areas — applied research and development, technology demonstration and deployment, and market facilitation. We respectfully recommend that the Commission:

- Retain and prioritize the research topic “Strengthening Critical Materials Supply Chains for Clean Energy Technologies” within this initiative.
- Within this topic's proposed scope — improving sourcing, refining, and manufacturing processes for energy-storage materials, and developing novel or alternative domestically available materials and processes — expressly include first-of-a-kind refining of domestically grown (phytomining-derived) nickel-bearing material into battery-grade product as an eligible, fundable activity, complementing rather than duplicating federal support for early-stage research.

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- Fund research and demonstration on processing phytomining-derived nickel to energy-storage-grade specifications, and on transparent life-cycle and supply-chain analysis relative to imported and recycled sources.
- Support research on recovery and processing of nickel-bearing residue into battery-grade product, including the thermal-conversion behavior of metal-bearing biomass, trace-metal capture, and residue management.
- Draft solicitation scopes to be technology-inclusive of emerging domestic supply pathways and to advance EPIC's equity goals through rural and tribal siting opportunities.

Specific Research Gaps EPIC 5 Is Well-Positioned to Address

- **Domestic primary supply demonstration.** Field-to-product demonstration of phytomining as a scalable, low-impact domestic source of nickel for the clean-energy supply chain, using a California-native species suited to in-state conditions.
- **Refining to battery-grade material.** Hydrometallurgical and related processing of phytomining-derived nickel to the specifications required for energy-storage applications.
- **Life-cycle and supply-chain analysis.** Transparent, peer-reviewable comparison of carbon and broader environmental footprint, and of supply-chain resilience, against imported and recycled nickel.
- **Emissions and residue management.** Characterization and advanced capture of particulate and trace-metal emissions when metal-bearing biomass is thermally converted, and safe recovery, stabilization, and beneficial processing of the nickel-bearing residue.

Request for Technology-Inclusive Solicitation Design

We ask that the EPIC 5 solicitation scopes implementing this initiative be drafted to admit emerging domestic supply pathways — including phytomining — on their technical and ratepayer-benefit merits, and that technology-demonstration and -deployment funding categories be structured so that novel, first-of-a-kind pathways can compete. We do not seek a set-aside; we seek scopes that are not inadvertently written to exclude innovative domestic-supply solutions that meet EPIC's benefit tests. As the portfolio matures, we also encourage the Commission to consider whether a dedicated domestic critical-minerals production topic would strengthen future investment cycles.

Conclusion

We commend the Commission for proposing an initiative focused on critical-materials supply chains and life-cycle benefits, and we strongly support its inclusion in the EPIC 5 Investment Plan. Bellus would welcome the opportunity to provide additional technical input to staff as the plan and its solicitations are developed, including participation in any future scoping workshops or requests for information. Thank you for the opportunity to comment.

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Public References

ARPA-E, PHYTOMINES Program — Project Descriptions (University of Florida award): arpa-e.energy.gov

UF/IFAS Horticultural Sciences, “Phytomining: Growing a U.S. Solution to the Nickel Supply Crisis” (Apr. 16, 2025): blogs.ifas.ufl.edu

USGS, Final 2025 List of Critical Minerals (Federal Register, Nov. 7, 2025): federalregister.gov

Respectfully submitted,

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Appendix: Phytomining Research Images

Illustrative images of the publicly documented phytomining research referenced above.



Figure 1. *Streptanthus polygaloides* plants selectively bred by the University of Florida

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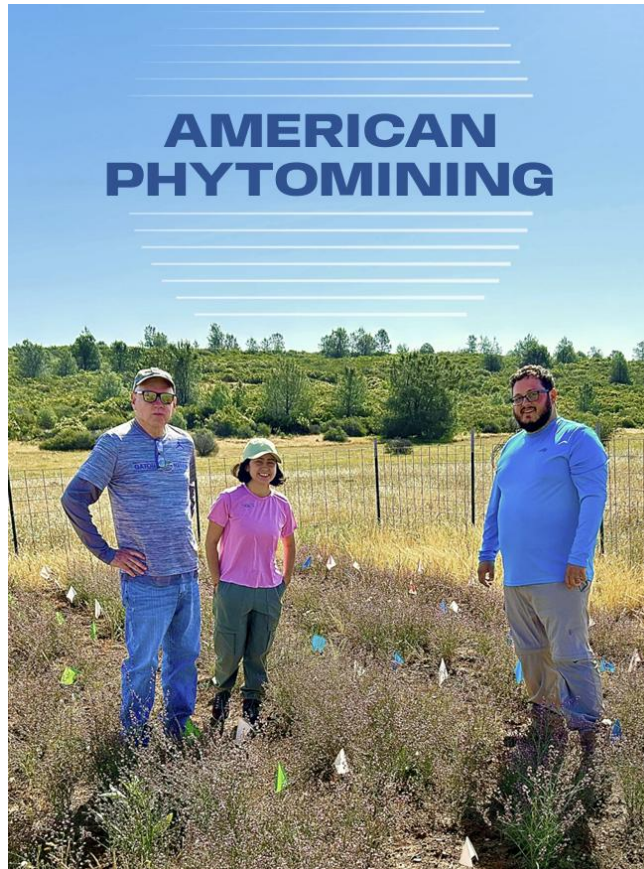


Figure 2. *University of Florida team at Streptanthus polygaloides test plot on East Bay Municipal Utility District (EBMUD) land in California.*