Should the U.S. Department of Energy Become a Critical Minerals Toll Processor?

written by Jack Lifton | August 11, 2026
Australia may already be showing the United States what to do.

For many years, the Australian Nuclear Science and Technology Organization (ANSTO) has worked with mining companies to develop flowsheets, conduct metallurgical test work, operate pilot campaigns, produce representative samples, and determine whether laboratory chemistry can be translated into an industrial process. ANSTO is a government organization, but its Minerals division provides practical services to private industry. In effect, it has long performed much of the work that an American critical minerals toll processing and process development center would be expected to perform.

ANSTO has now taken the concept a significant step further. With Australian government support through the Australian Critical Minerals R&D Hub, it has constructed a new pilot scale rare earth processing facility at Lucas Heights. The facility is intended for use by companies developing Australia's ionic adsorption and other clay hosted rare earth deposits.

Australian Rare Earths Ltd. **(ASX: AR3)** has been selected as the facility's first industry partner. AR3 is developing the Koppamurra ionic clay rare earth project in South Australia. It will use the ANSTO facility to refine its flowsheet, optimize integrated pilot operations, and produce samples for potential customers and strategic partners. ANSTO describes the facility as a shared national capability that will also be available to other companies.

This is precisely the point. Each Australian mining junior will not have to build its own pilot plant simply to determine whether its deposit can be processed. The Australian government has created common infrastructure through which actual feedstocks can be tested, processes can be validated, and customer qualification samples can be produced.

Why Should the United States Not Do the Same Thing?

The United States has spent billions of dollars studying how to extract, separate, refine, reduce, alloy, recycle, and otherwise process critical minerals and materials. Much of this work has been carried out through the immense research establishment of the United States Department of Energy: its national laboratories, universities, contractors, pilot plants, demonstration facilities, and specialized analytical centers.

The DOE today possesses more collective scientific knowledge about critical material processing than any American mining company—or, for that matter, any group of American mining companies. Yet the United States remains overwhelmingly dependent upon foreign nations, principally China, for many of the refined critical materials required by American industry. This raises an obvious question: Should the Department of Energy stop limiting itself to researching critical mineral processing and begin processing critical minerals for customers on a toll basis? My answer is yes—but only if we understand exactly what problem toll processing is intended to solve and exactly where the government's role must end.

The DOE should operate pilot and demonstration scale toll processing facilities alongside private industry. It should not ordinarily attempt to replace private industry as a permanent

commercial producer. That distinction is critical.

What is Toll Processing?

A toll processor does not normally own the feedstock it processes or the product it produces. A customer delivers a concentrate, intermediate, scrap, residue, or chemical solution to the processor. The processor converts that material into an agreed product and charges a fee for doing so. This model is common throughout the chemical, pharmaceutical, metallurgical, and specialty material industries. It allows a company to obtain a product without first building an entire processing plant of its own. This could be especially valuable for critical minerals, as many proposed American projects are too small, too early, or too poorly financed to justify building a dedicated refinery. A mining company may be able to produce a few tons of concentrate for testing, but it cannot persuade investors to finance a processing plant until it proves that its concentrate can be processed economically. The company is caught in a circular argument. It cannot obtain financing without demonstrating a process, and it cannot demonstrate the process without obtaining financing.

This is the so-called valley of death between laboratory success and commercial production. In critical minerals, it might better be called the valley of PowerPoint presentations. Too many projects remain there indefinitely. A DOE toll processing facility could provide the missing bridge. ANSTO’s Australian model demonstrates that this is not a theoretical idea. It is an industrial development service that a national scientific organization can provide.

The DOE Is Already Moving in This Direction

The idea would not require the government to invent an entirely new institution. The DOE already supports bench, pilot, demonstration, and scale up work throughout the national laboratory system. Its Critical Minerals and Materials Accelerator is intended to move technologies from bench scale innovation toward commercially viable operation through industry led partnerships supported by the national laboratories. The department has also funded pilot scale facilities for rare earths, magnesium, gallium, germanium, and other critical materials. Its Critical Minerals Supply Chain Research Facility brings together expertise from nine national laboratories to validate, optimize, and commercialize processing technologies.

The DOE’s METALLIC initiative is already organized around such practical tasks as feedstock characterization, beneficiation, extraction, separation, refining, and materials production. The infrastructure, scientific competence, and statutory mission therefore largely exist. What is missing is an operating model that allows qualified American companies to bring representative feedstocks into these facilities and purchase defined campaigns of process development and pilot production. The word “representative” is important. A carefully selected laboratory sample can prove that a chemical reaction is possible. It cannot prove that a variable natural feedstock can be processed continuously, economically, and reproducibly. Industrial success is not demonstrated by producing a gram of pure material. It is demonstrated by repeatedly producing the specified material from real feedstock at an acceptable yield and cost.

What the Government Could Do That the Market Is Not Doing

A national toll processing system could perform several useful functions. First, it could characterize actual domestic feedstocks using standardized analytical methods. Today, developers frequently present assays prepared by different laboratories using different sampling procedures. Comparisons between projects are therefore often misleading. Second, it could test alternative process flowsheets using common equipment and independently measured mass balances. Third, it could produce kilogram or ton scale samples for qualification by downstream customers. No original equipment manufacturer can qualify a PowerPoint presentation. It must qualify a material produced by a controlled and reproducible process. Fourth, it could determine where value is actually added. A deposit may contain rare earths, lithium, gallium, germanium, antimony, or another critical element, but the presence of an element does not make it a commercial product. The material must be economically concentrated, chemically separated, purified to specification, and delivered in the form required by an industrial customer.

Finally, such facilities could train the chemical engineers, metallurgists, plant operators, analytical chemists, and maintenance personnel whom the United States will need if it is serious about rebuilding these supply chains.

Workforce development cannot be achieved by holding conferences. Operators learn by operating.

The Danger of Government as a Permanent Producer

The case for DOE pilot toll processing is strong. The case for the DOE replacing private processors is much weaker. Research establishments and commercial manufacturing organizations serve different purposes. A national laboratory is rewarded for discovery, publication, patents, technical milestones, and successful demonstrations. A commercial processor survives only if it controls cost, maintains throughput, meets delivery schedules, manages waste, adapts to feed variability, satisfies customers, and produces the same product every day. These are not minor administrative differences. They are the essence of industrial production.

A government facility can continue operating after it misses its cost target. A private toll processor cannot. A government program may define success as the completion of a three year research contract. An industrial customer defines success as receiving the qualified product on time and at the agreed price.

This suggests what I will call **Lifton's Law of Government Process Development**:

Government can finance the acquisition of knowledge, but it cannot repeal the discipline of the marketplace.

If DOE facilities offer permanently subsidized processing below their true cost, they will discourage the very private investment they are supposed to encourage. Investors will not finance a competing private facility if they believe the government will process the same material indefinitely at an artificial price. Even worse, political priorities could replace commercial priorities. Feedstocks might be selected because of congressional geography, publicity, or the lobbying ability of

their owners rather than their likelihood of becoming economically useful sources of critical materials. We have already spent too much money confusing geological occurrence with industrial supply.

The Proper Model

The government’s role should therefore be transitional, transparent, and disciplined. DOE facilities should accept projects through a technically qualified, competitive process. Customers should pay a meaningful portion of the operating cost. Each campaign should have defined objectives: recovery, purity, throughput, reagent consumption, energy consumption, waste generation, product specification, and estimated commercial cost.

The results should be independently audited. Proprietary process information can remain protected, but claims made with public money should be supported by verified data. Most importantly, every successful program should contain a commercialization exit plan. Once a process and feedstock have been demonstrated, the activity should be licensed, transferred, sold, or otherwise moved into private commercial operation.

The objective should not be to create a permanent federal rare earth refinery. The objective should be to create enough verified technical and economic information for private capital and industrial customers to make rational decisions. There may be exceptions. If a material is indispensable to national defense, required only in small quantities, and incapable of supporting an independent commercial facility, the government may have to maintain a strategic production capability. The United States already accepts this principle in other areas of national security.

But an exception created by genuine strategic necessity must not become a general excuse for government ownership of uneconomic projects.

Alongside Industry, Not in Place of It

The United States does not principally suffer from a shortage of mineral discoveries. It suffers from a shortage of demonstrated, financeable, customer qualified processing capacity. That is precisely where the DOE can make its greatest contribution. It can provide shared facilities that no early stage company could afford. It can produce reliable mass balances. It can compare processes. It can make qualification samples. It can train operators. It can determine whether a process works continuously rather than occasionally. And it can expose projects whose economics disappear when confronted with representative feedstock and an honest accounting of recovery and cost. That last function may be as valuable as discovering a successful process. Preventing a billion dollars from being wasted is also a productive result.

Australia, through ANSTO, has recognized that shared government supported pilot infrastructure can accelerate private industrial development without requiring the government to become the permanent owner of every resulting production plant.

The DOE should follow that example. It should enter the toll processing business at the pilot and demonstration levels, working with private companies and real industrial customers. Its facilities should be bridges from research to production, not destinations where projects remain permanently dependent on federal subsidies. The government should prove capability. Industry should assume production. Customers should determine

value.

And, as always, we should follow where value is added.