Unlocking Strategic Rare Earth Elements

from Coal and Coal Waste Streams

Executive Federal Brief – Spring 2026

Prepared for Interagency Review

U.S. Critical Minerals &
Industrial Resilience Initiative

National Security / Appalachian
Industrial Revitalization Initiative

Prepared by

Roger D. Ford, M.A.

James A. Titmas, P.E.

John Dodson, P.E., M.B.A.

Kent Sowards, M.B.A.

Spring 2026

I. Strategic Imperative

Rare earth elements (REEs) are foundational inputs to U.S. defense systems, advanced manufacturing, aerospace platforms, grid infrastructure, electric mobility, and emerging energy technologies. Yet the United States remains structurally dependent on foreign-controlled processing and separation infrastructure.

Downstream Processing Concentration Risk

Segment	China Share
Mining	**65–70%**
Separation	**85–90%**
NdFeB Magnets	**~90%**

The strategic vulnerability is not geological scarcity. It is downstream processing concentration.

Defense systems—including fighter aircraft, radar systems, precision-guided munitions, satellites, and electronic warfare platforms—depend on specific rare earth oxides and alloys that cannot be readily substituted without performance degradation.

Mitigating this exposure requires domestic, scalable, environmentally responsible processing pathways capable of bypassing foreign chokepoints.

II. The Domestic Resource Opportunity: Coal-Derived Feedstocks

Over the past decade, DOE, NETL, and USGS research has established that coal and coal-derived materials constitute a viable domestic rare earth resource base.

Coal-derived materials include:

- Coal combustion products (fly ash, bottom ash, boiler slag)
- Preparation plant refuse
- Slurry impoundment solids
- Acid mine drainage (AMD) precipitates

Many Central Appalachian coal-derived materials exceed **300–400 ppm ΣREE**, a threshold considered “promising” for recovery under federal screening criteria.

Importantly:

- These materials are already mined.
- They are surface-accessible.
- They are geographically mapped.
- They are already regulated.

They are frequently concentrated through combustion and beneficiation. Unlike new hard-rock mining projects, coal-derived REE recovery avoids:

- Greenfield exploration risk
- Extended federal permitting timelines
- Community opposition associated with new mining activity
- The resource exists.

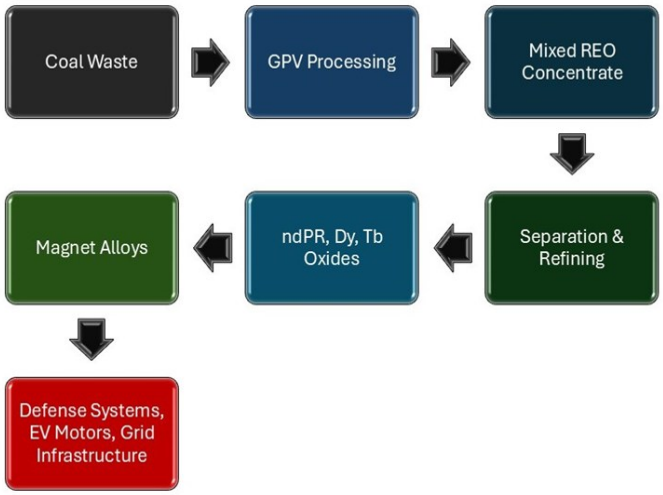
The commercialization platform is the missing link.

III. Gravity Pressure Vessel (GPV) Systems as Enabling Infrastructure

Federal research has validated multiple REE extraction chemistries at bench and pilot scale.

Commercial deployment has stalled due to:

- High reagent intensity
- Elevated water consumption
- Secondary waste generation
- Lack of scalable industrial processing platforms



Gravity Pressure Vessel (GPV) systems are proposed as integrated industrial reactor infrastructure capable of hosting DOE-validated extraction chemistries under controlled pressure and temperature environments.

GPV systems provide:

- Enhanced mineral liberation and reaction kinetics
- Reduced reagent intensity
- Closed-vessel environmental containment
- Modular, feedstock-proximate deployment
- Integration with existing industrial and brownfield sites

GPV technology is not a speculative chemistry.

It is scalable reactor infrastructure designed to operationalize validated extraction pathways at commercial throughput. The system is intended to function analogously to a refinery within conventional mining value chains—standardized, modular, and repeatable.

IV. Why Appalachia: Strategic Deployment Platform

Central Appalachia—particularly southern West Virginia and the Kanawha–Ohio River corridor—offers uniquely aligned commercialization conditions:

Feedstock Density

- High concentration of REE-bearing coal-derived materials
- Legacy refuse and slurry assets

Infrastructure

- Multimodal logistics (river, rail, interstate)
- Brownfield industrial sites
- Power and water availability

Workforce

- Mining, chemical processing, power generation skill base
- Existing community college and university training infrastructure

Regulatory Alignment

- Existing frameworks for coal material handling
- Beneficial use pathways for post-extraction mineral solids (PEMS)

This alignment enables pilot, demonstration, and replication without greenfield mining barriers. Appalachia can transition from legacy energy dependency to strategic mineral leadership.

V. Workforce & Economic Impact (Per Modular GPV Facility)

Based on BLS OEWS May 2024 wage anchors and standard BEA RIMS II / IMPLAN multipliers:

Direct Employment

- 35–62 full-time positions
- Operations, maintenance, instrumentation, QA/QC, EHS, logistics, supervision

Wage Bands

- West Virginia: ~$55,000–$70,000
- Kentucky: ~$60,000–$80,000
- Supervisory/controls roles: $70,000–$105,000

These wages exceed regional manufacturing medians and support stable, middle-to-upper-middle-income employment.

Total Employment Impact

- 70–210 jobs per facility (direct + indirect + induced)

Beyond REE output, GPV systems generate stabilized post-extraction mineral solids (PEMS) suitable for:

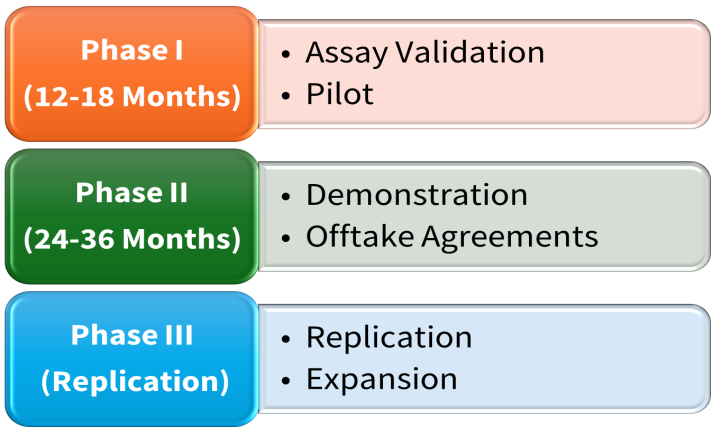
- Road base and subbase
- Structural fill and embankments
- Mine reclamation
- Concrete and masonry inputs
- Industrial site preparation

This circular-economy architecture couples critical mineral production with environmental remediation and infrastructure development.

VI. Phased Federal Deployment Strategy

Phase I – Feedstock Characterization & Pilot Testing

- Site-specific assay validation
- Pilot GPV deployment
- Techno-economic modeling
- DOE/NETL alignment



Phase II – Demonstration-Scale Facility

- Meaningful throughput
- Permitting validation
- Offtake development
- Investor underwriting

Phase III – Modular Replication

- Distributed, feedstock-proximate facilities
- Regional supply chain scaling
- Downstream separation alignment

Demonstration-scale validation is the inflection point for:

- Federal confidence
- Private capital participation

- Defense supply chain integration

VII. National Security & Industrial Sovereignty Implications

Coal-derived REE recovery:

- Reduces foreign chokepoint exposure
- Strengthens defense industrial base resilience
- Anchors advanced manufacturing domestically
- Aligns environmental remediation with mineral production
- Establishes a replicable model for other coal regions

This is not solely an environmental initiative. It is a strategic industrial intervention.

Domestic rare earth supply chains are a national security imperative.

VIII. Federal Action Framework

To accelerate deployment, federal and state policymakers should:

1. Prioritize coal-derived REE demonstration projects in Central Appalachia.
2. Align DOE, DoD, ARC, and Title III funding pathways toward integrated processing platforms.
3. Clarify regulatory classification of coal-derived REE recovery as materials processing rather than new mining.
4. Support downstream separation, refining, and magnet capacity expansion.
5. Encourage public-private partnership financing structures for modular replication.

Conclusion

The United States has already mined the resource. It has already funded the research. It now requires commercial deployment.

Coal waste is not a relic of the past. It may be one of America's most strategically positioned domestic critical mineral assets.

Biographies

Roger Ford, M.A. — President, Eureka Energy Corporation

- Nationally recognized energy strategist focused on grid resiliency, distributed systems, and critical mineral commercialization
- Architect of the "Energy Citadel" framework — co-located energy, advanced manufacturing, and data infrastructure for industrial resilience
- Pioneer in circular feedstock systems, including early biomass commercialization models in Central Appalachia
- Executive leadership spanning energy infrastructure development, strategic deployment modeling, and public-private capital structuring
- Board Member, Global Energy Foundation — energy integration and infrastructure security research
- Author, *Appalachia Rising* (forthcoming 2027) — regional industrial revitalization strategy

James A. Titmas, P.E. — Senior Engineer, GeneSyst GPV Technologies, Inc.

- 60+ years engineering leadership in energy, infrastructure, and advanced environmental systems
- U.S. Army Corps of Engineers (Airborne Ranger Officer); U.S. Army Reserves service
- Professional experience spanning power generation, gasification, emissions control, wastewater systems, and thermal/chemical mass balance
- Principal inventor on 26 U.S. patents including supercritical wet oxidation, CO_2 recovery, toxic metal capture, and waste-to-value conversion systems
- Led or contributed to 800+ infrastructure projects across 24 U.S. states and 19 countries
- Experience includes chemical/biological demilitarization systems and radioactive waste reduction technologies
- Distinguished Alumni Award, University of Akron College of Engineering

Kent Sowards, M.B.A.— Center for Business and Economic Research at Marshall University

- Director, Center for Business and Economic Research, Marshall University
- Associate Director, Appalachian Transportation Institute
- Associate Director, Marshall University Resiliency Center
- 27-year career in economic research, transportation systems analysis, and regional policy modeling
- Author or contributor to 150+ technical reports for federal and state agencies
- Research informs infrastructure investment, rural economic strategy, and legislative decision-making
- Former appointee, Governor's Tax Modernization Project
- Member, Transportation Research Board Inland Waterways Subcommittee

John Dodson, P.E., M.B.A., National Security Strategist

- Owner & Executive Director, Thayer Gate Energy
- U.S. Military Academy (West Point) graduate — B.S. Engineering
- MBA, Harvard Business School
- 14 years active-duty U.S. Army service; Special Forces (MACV-SOG), Engineer Company Commander, Army Aviator
- Decorations include Silver Star and four Bronze Stars
- Former Professor of Economics and Energy Policy, West Point
- Executive leadership in resilient microgrids, HVDC transmission, and distributed energy systems
- Guardian Grid and West Point Microgrid initiatives briefed at the White House and developed with U.S. Army Corps of Engineers

Project Contact & Technical Access

Project Inquiries & Interagency Coordination
Coal-Derived Rare Earth Commercialization Initiative
Spring 2026 Federal Briefing Executive Summary

Roger D. Ford, M.A.
President
Eureka Energy Corporation
Direct: (307) 352-2498
Email: roger@eureka-energy.com
Office: Sheridan, Wyoming 82801
Strategic deployment, commercialization, federal partnership coordination

James A. Titmas, P.E.
Senior Engineer, GeneSyst GPV Technologies, Inc.
Technical systems architecture, GPV integration, process engineering

Kent Sowards, M.B.A.
Director, Center for Business and Economic Research
Economic impact modeling, regional deployment analytics

John Dodson, P.E., M.B.A.
National Security Strategist
Thayer Gate Energy
Defense infrastructure integration, resilient energy systems alignment

Technical Access
Download Full Technical Whitepaper & Appendices