Response to Request for Information: DE-FOA-0002794
RE: Department of Energy's Critical Materials Research, Development, Demonstration, and Commercialization Application Program

This Response corresponds with my outstanding RFI to the DE-FOA-0002686 Program for Office of Fossil Energy and Carbon Management – BIL REE Demonstration Facility

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This is a Response to the Request for Information (**RFI DE-FOA-0002794**) issued by the U.S. Department of Energy's (DOE) on behalf of the Office of Fossil Energy and Carbon Management (FECM) and the Office of Energy Efficiency and Renewable Energy (EERE).

This RFI details a proposed project that will:

- Diversify and expand the supply from a wide range of sources that are economically viable and minimize environmental impact, including the co-production of minerals and materials (from mining waste and co-products); • Utilize materials with assured supply; • Increase material and manufacturing efficiency across the supply chain (by establishing a fully integrated domestic value chain), • ensure the long-term, secure, and sustainable supply of critical materials; and • prioritize work in areas that the private sector by itself is not likely to undertake due to financial or technical limitations • Material and process efficiency across the full supply chain; • Diversify domestic sources, including waste streams; • Advanced extraction, production, separation, alloying, or processing that decrease energy consumption, environmental impact, and costs of those activities; • Provide guaranteed supply of Nd, Pr, Tb and Dy in proportions that exceed current NdFeB magnet imports from China • Proven downstream JV partners that include separation, metallics and fabrication • End China's rare earth magnet monopoly

Statement of Current U.S. Capabilities:

The current reality of U.S. resource capabilities is in stark contrast to needs. The geochemistry of MP Materials is grossly deficient. The Tb and Dy levels within the MP Materials Mt. Pass deposit are measured at "TRACE" levels by the USGS and all other authoritative bodies.

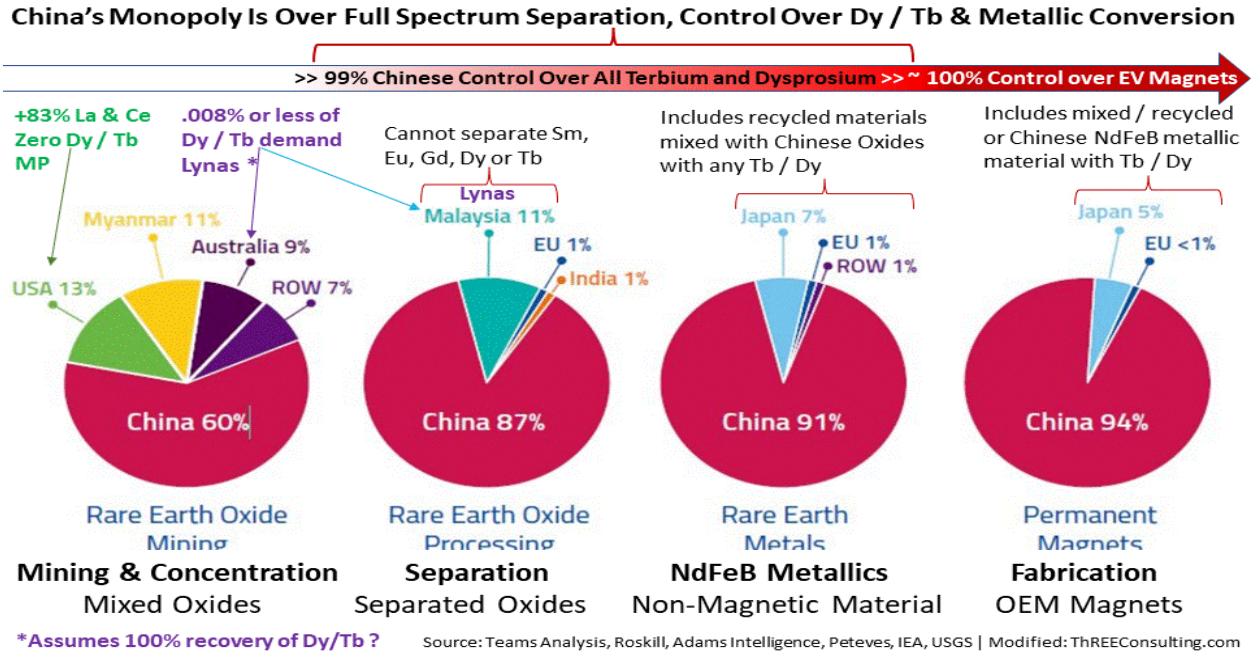
The Tb and Dy levels at the Lynas, Mt. Weld deposit are marginally better, but still inadequate to U.S. needs as it relates to EVs, military applications and other green tech applications.

The Blue Line / Lynas facility may contribute small amounts of Tb and Dy, but not in the proportions needed for the U.S. be independent of China for our green tech and national security needs.

The underlying resource problem is the lack of Tb and Dy in 'western' oriented deposits. This, of course, is related to the aversion to thorium rich deposits that tend to have much higher levels of Tb and Dy.

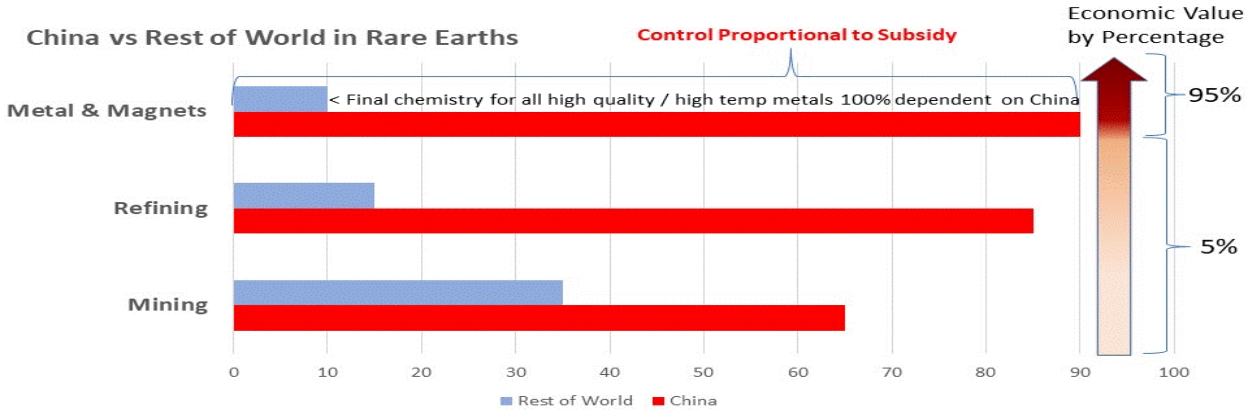
This resource problem is compounded by the downstream deficits in separation, metallics and fabrication. Any forthcoming solution will need to fully resolve all of these issues.

U.S. is 100% Dependent on China for all High-Temp / EV / Military Grade NdFeB Magnets



The U.S. has no (zero) integrated rare earth magnet capabilities. In fact, our only producing mine ships its valuable rare earth resources to China. MP Materials plan to produce 1,000 tons of NdFeB magnets does not solve any national security issues or answer the Administration's goals of producing EVs or other green technology because the Mt. Pass deposit cannot produce Tb or Dy in any meaningful amount. NOTE: NdFeB magnets without Tb or Dy doping cannot be used in any EV critical systems, wind turbines or military applications.

These facts are ignored by everyone who pretends to be in the business of assessing the situation.

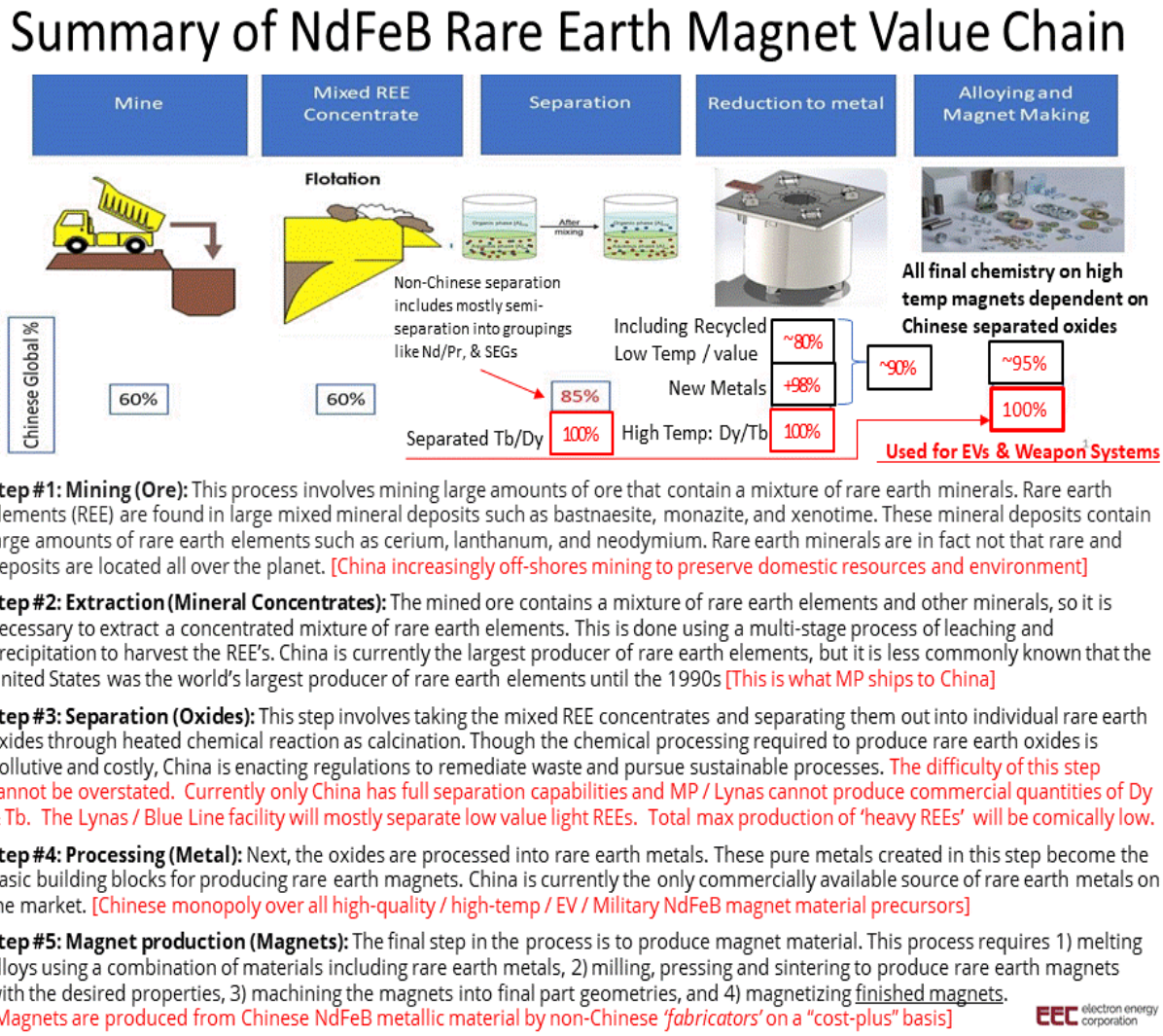


China is actively outsourcing the mining of rare earths to other countries by creating high margin opportunities in the resource production phase. Notice the extreme value-compression in the metal to magnet phase. 95% of all rare earth value creation happens at this level, but there are no corresponding profits due to Chinese subsidies. China cannot be expected to surrender or share this portion of the value chain.

China's current magnet and metals capacity exceeds 150% of global demand. Planned future-capacity exceeds 250% of current global demand. U.S. metals and magnet capacity Essentially 0% (zero) for new NdFeB magnets.

In summary, the development of a domestic rare earth value chain will remain intractable until a fully integrated solution is put forward and fully supported by the government, off-taker / end-users and the finance industry.

The following graphic details the various stages in the value chain and how China retains control over the downstream side rare earth magnet production – and specifically on the production of high-value high-temperature magnets requiring separated Tb and Dy.



Step #1: Mining (Ore): This process involves mining large amounts of ore that contain a mixture of rare earth minerals. Rare earth elements (REE) are found in large mixed mineral deposits such as bastnaesite, monazite, and xenotime. These mineral deposits contain large amounts of rare earth elements such as cerium, lanthanum, and neodymium. Rare earth minerals are in fact not that rare and deposits are located all over the planet. [China increasingly off-shores mining to preserve domestic resources and environment]

Step #2: Extraction (Mineral Concentrates): The mined ore contains a mixture of rare earth elements and other minerals, so it is necessary to extract a concentrated mixture of rare earth elements. This is done using a multi-stage process of leaching and precipitation to harvest the REE's. China is currently the largest producer of rare earth elements, but it is less commonly known that the United States was the world's largest producer of rare earth elements until the 1990s [This is what MP ships to China]

Step #3: Separation (Oxides): This step involves taking the mixed REE concentrates and separating them out into individual rare earth oxides through heated chemical reaction as calcination. Though the chemical processing required to produce rare earth oxides is pollutive and costly, China is enacting regulations to remediate waste and pursue sustainable processes. The difficulty of this step cannot be overstated. Currently only China has full separation capabilities and MP / Lynas cannot produce commercial quantities of Dy & Tb. The Lynas / Blue Line facility will mostly separate low value light REEs. Total max production of 'heavy REEs' will be comically low.

Step #4: Processing (Metal): Next, the oxides are processed into rare earth metals. These pure metals created in this step become the basic building blocks for producing rare earth magnets. China is currently the only commercially available source of rare earth metals on the market. [Chinese monopoly over all high-quality / high-temp / EV / Military NdFeB magnet material precursors]

Step #5: Magnet production (Magnets): The final step in the process is to produce magnet material. This process requires 1) melting alloys using a combination of materials including rare earth metals, 2) milling, pressing and sintering to produce rare earth magnets with the desired properties, 3) machining the magnets into final part geometries, and 4) magnetizing finished magnets. [Magnets are produced from Chinese NdFeB metallic material by non-Chinese *'fabricators'* on a "cost-plus" basis]

EEC electron energy corporation

Above: Originally produced by John Ormerod, with all edits reviewed and confirmed by the same

The remainder of this submission is identical to my DoE DE-FOA-0002686 RFI

The balance of this document details our proposed "mine to fabricated magnet strategy". The proposal details how this project could meet 100% of U.S. rare earth magnet imports in less than 3 years. Production would double within 7 years. The integrated facility could serve other domestic and foreign suppliers – thus enhancing diversity of supply. The proposal relies exclusively on proven resources and proven technology partners.

Confirmation of DoE DE-FOA-0002686 Requirements & Qualification Statement:

- *Conventional separations technologies: This Project will utilize conventional technologies for the extraction and concentration of mixed rare earth oxides. These mixed oxides will be transferred to our vertically integrated downstream campus to be separated into individual oxides by conventional technology, converted into metals and magnetic materials and fabricated into magnets for OEM customers by conventional technology. Each segment of our full-vertical integrated value chain will operate under the control of our Joint Venture Partners who have proven capabilities at commercial scale.*
- *Unconventional feedstock resources: Our project will initially utilize our own unconventional resource feedstock. This resource is contained within the accumulation of 40-years of mining waste, comprising of the phosphate-rare earth mineral apatite in the tails storage facility ("**TSF**"). This resource will supply the JV-Partnership for the first 7 to 10-years. With the reopening of the underground mine, the JV will begin utilizing the underground rare earth element ("**REE**")s from the breccia pipe In Situ deposits, and the REEs from the underground In Situ magnetite deposits (further described below). Our downstream facilities will also be able to use other unconventional feedstocks such as RE oxides extracted from coal and oxides from conventional producers such as MP Materials or Lynas.*

A. FACILITY DEFINITION

1. Do you have an existing facility that can be used/modified-retrofitted to meet the requirements of the demonstration facility? *Yes. The Lead JV Partner owns the Pea Ridge mine in Washington County Missouri that will be used for the mining and refining of mixed rare earth oxides. The Lead JV Partner also owns 750-acres of industrial real estate along the Mississippi River that may be utilized as the downstream site for REEs separation, metallic conversion and OEM magnet fabrication. The combined facilities will have the capabilities to solve the current Administration's misalignment between U.S. EV production deadlines vs production and availability of REE magnets to support such production/EV conversion deadlines. Without this Project, and also based on the timeline as proposed in the DOE RFI, the U.S. will not be able to support U.S. EV manufactures needs for critical REE magnets required in the production of EVs (and other technologies) and the U.S. will consequently remain at the mercy of the Chinese.*

If appropriate, describe your facility. *The facility ("**Project**") will be organized, owned, constructed, controlled and operated under a company ("**Company**") comprised of a vertically integrated Joint Venture Partnership structure with multiple joint venture partners ("**JV Partner**"). Under the JV Partner structure of our Company, all six technology JV Partners have or will establish U.S. facilities. The configuration of the JV Partners is based on the desire to allow for transfer pricing between business segments in response to anticipated Chinese monopoly pricing strategies and internal subsidies. Each of these JV Partners in their existing companies utilize on and off-patent processes, formulas and designs. Because all of our JV Partners have long-term, established off-take customers, the transfer of products between the JV Partners and sales to original equipment manufacturers ("**OEM**") end-users will be managed internally. The Project and related facilities will be designed on a life-of-mine supply agreement, estimated to be approximately 40 years, and will result in the production of over 700,000 tons of REEs products. Beyond the Company's resources, we anticipate becoming the primary off-take partner for most U.S., Canadian and other regional REEs mining companies. What is unique about this approach is that every JV Partner brings one-hundred percent of what is needed to complete the task. There are no technology or process gaps.*

The JV Partners and their primary roles are generally described as follows: 1) The mine is wholly owned by the Lead JV Partner and was operated for 40 years as a producer of high-grade iron ore concentrates (the Pea Ridge Mine in Washington County Missouri)[i]*. Historically all of the rare earth phosphate mineral (REEs enriched) apatite was treated as a waste-material and deposited in the tail's storage facility ("**TSF**"). The TSF contains 120,000 tons of REEs. The mine has three separate REEs deposits. All three deposits have commercially recoverable levels for all 16 rare earths*[ii]*. The mine is fully permitted through the state of Missouri. 2) The Mixed Oxide JV Partner will reclaim and concentrate a number of commodities from the TSF, including the REE-Phosphate mineral apatite as well as extract and produce mixed 98% grade rare earth oxides ("**REO**"s). 3) The mixed REOs will be then be transferred to our downstream facility for separation into individual REOs by the Separation JV Partner. 4) The separated REOs will be converted into metals and magnetic materials by the Magnet Materials Production JV Partner.* This JV Partner is one of only three REEs magnet makers not under Chinese ownership, control or influence. As previously pointed out, it is also important to note that all of the necessary REEs for magnet fabrication are available from this Project, with no reliance on China. *5) The magnet materials will be fabricated into OEM ready magnets by the Magnet Fabrication JV Partner who has a long operating history as a REEs magnet producer/fabricator outside of China. 6) The Academic JV Partner will coordinate with our JV Partners and co-develop job-skills/co-training programs for future employees. They will also act as our leading social equity/out-reach partner through sponsored scholarship science, technology, engineering and math ("STEM") programs and enhanced high school science programs. Our Academic JV Partner is ranked by U.S. News and World Report as a top 100 performer in administering social mobility programs.*

The Project requires approximately $2,500,000,000 USD in the form of up-front construction financing to complete the construction of all of the components of the Project. The Project will be obtaining the necessary capital for design and construction of the Project through a debt/equity placement offering and various forms of Federal support.

2. Please define demonstration-scale as you see it and explain why. *None required – See description of Project in A.1 above.*

3. Regarding REE demonstration facility sizing, please address the following:

a. Please comment as to whether a demonstration facility is the correct size in view of where current technology development is for REE and CM extraction, separation, and recovery from unconventional feedstock resources. *No. A demonstration facility will prolong China's control over REEs. This Project will support 100% of current REE magnet import demand and produce other rare earth products such as metals and alloys. The second phase of development (circa 2027/8) could equal approximately 200% or more of current demand The success of the first phase and expansion of the second phase will be largely dependent upon the enactment of various tax credits to assure competitive pricing against China's subsidized magnet production cost or some other consideration*[iii] *(please see footnote). Promoting and funding demonstration facilities may greatly delay commercial production of critical rare earth products, allowing China to dominate the anticipated growth in EV and other green tech markets over the next decade (DoE FOA targets: 10% of U.S. demand by 2035 and 20% of U.S. demand by 2040 vs Administration targets of 50% EVs by 2030).*

b. Please discuss your thoughts on whether an intermediate-scale facility is needed to be constructed and operated in advance of, or in parallel with, the design, construction, and operation of the demonstration-scale facility. *N/A – see description of Project in A.1 above.*

i. Please define "intermediate-scale" from your perspective. Please discuss whether your process is ready for demonstration. *N/A – see description of Project in A.1 above.*

4. Regarding feedstocks, please address the following:

a. Besides AMD fluids and precipitates and mine wastes (refuse tailings), please comment as to what types of materials should be considered as "deleterious materials" to be used as unconventional feedstock resources. *Thorium, Uranium and other tailings materials. Also see feedstock resources listed in A.4.b.i. below.*

b. Does your prospective or current facility provide for the use of multiple feedstock resources? *Yes. The downstream facility will be designed to accept alternate mixed oxide concentrates from conventional or unconventional sources.*

i. If yes, please describe the resources and quantity of these resources that would be used during operation. *Our Response is for the development of a vertically integrated Project that can obtain 100% of its resources from a U.S.* mine *site which includes adequate supplies of approximately 274,600,000 tons of material containing approximately 700,000 tons of REEs which are available to support the 40-year life of the Project with no dependence on China. The three Project resources are generally described as follows:*

1) TSF. 24.5 million metric tons of tailings/ore containing 4997 ppm REEs (plus other resources). REEs distribution is based on an engineering resource assessment prepared in 2013. The engineering resource assessment estimated approximately 2.4 million metric tons of REE-Apatite (10% of total content) in the tailings. Testing work and reports successfully produced a 96% REO concentrate, a phosphoric acid product, a +65% Fe hematite product and a chemical grade magnetite product and pyrite concentrate (containing Co, Ni, Mo, Cu);

2) Underground Breccia Pipe Deposit. An underground breccia pipe deposit at the Project site was classified as world class by USGS in the early 1980's. This deposit contains approximately 600,000 metric tons of reserves (proven by USGS in 1981) with an average of 12 percent RE_2O_3 (1990). REEs distribution is based on the average of composite assays of samples from four breccia pipes, (1989) (and conforms with USGS reports); and

3) Underground REEs – Apatite in Fe Ore. Engineers estimated iron ore reserves of 250 million tons (NI 43-101 standards). REE-Apatite content estimate is based on measured REE-Apatite accumulated in tailings over a 40-year operating history and confirmed by the known geochemistry of ore body.

It is important to note that all sixteen commercial rare earths are economically recoverable and all six critical REEs required for magnet fabrication (Pr2O3, Nd2O3, Sm2O3, Dy2O3, Tb2O3 and Dy2O3 – and Co as a byproduct of pyrite) are recoverable at quantities equal to approximately 100% of all RE magnets imported to the U.S. in 2020 (with production volumes scheduled to double by 2027/8 if there is sufficient demand and/or necessary tax credits). The Project requires NO dependence on China for any of the necessary REEs for OEM magnet fabrication.

ii. If no, please describe possible process and/or facility modifications, if any, that would be needed to assure successful operation of your facility should multiple feedstock materials be used. *N/A.*

c. Would including the ability to incorporate multiple feedstocks in your demonstration facility mitigate risks or increase them? *The overall Project design anticipates the utilization of multiple feedstocks, including REEs derived from coal and concentrates and mixed oxides from conventional producers such as MP Materials and Lynas. Incorporation of multiple feedstocks in our Project would allow for expansion of current production targets, mitigate risks, and extend the life of the Project.*

Please specify affected risks and elaborate. *Incorporating multiple feedstocks in our Project would mitigate resource supply risks by adding additional feedstocks to the existing resources. However, all of the existing resources are available (subject to mining costs), so multiple feedstocks would, in theory, simply extend the life of the Project. The additional risk could be that costs for these additional feedstocks could be greater than utilization of our existing Project resources.*

5. Related to the possibility of a user facility, please comment on the following: a. Would your prospective facility be able to support slipstream testing of advanced concepts, processes, sensors, and/or equipment being developed by external contractors who would not be supported under award for the development and operation of your demonstration facility? If so, please comment. *The systems will be designed to be inherently flexible and while we cannot fully anticipate what slipstream technologies may be proposed to be integrated into the production stream, there will be accommodation for future collaboration and ports at points of access in the systems.*

i. If yes, what modifications, if any, would be required? *Unknown at this time.*

a. Please estimate the cost of the modifications. *Unknown, until such slipstream requirements are identified.*

b. Please estimate the schedule impact of the modifications. Would the overall timeline of the demonstration facility coming online be impacted? *Yes.*

If yes, please explain. *The impact of these slipstream requirements is unknown at this time.*

ii. If no, what are the impediments? Please elaborate. Please provide your thoughts on what it would take to overcome these impediments (including cost and schedule). *Unknown, until such slipstream requirements are identified.*

iii. Would a phased approach be necessary such as beginning operations without the user facility and incorporating it at a later time? If so, when is the appropriate time? *Our proposed Project will be constructed in two phases. Phase One is for a 10,000 tons per year ("**tpy**") refining to OEM magnet operation. Phase Two may increase to 20,000 tpy or more, based on increased production at our mine site and/or the utilization of additional rare earths from conventional or unconventional resource suppliers and off-take agreements (largely conditional upon demand, supported by tax credits or other considerations).*

b. What concerns, if any, do you have regarding the possible use of the demonstration facility as a user facility with slip streams for R&D projects? Please be as explicit as you can. *Our Project will be a full-scale operating facility. Our JV Partners have already demonstrated commercial production at each step of the mine to metals production and unable to perform as a demonstration facility.*

6. After DOE's involvement in the demonstration facility concludes, what obstacles would need to be overcome for you (or another stakeholder) to continue operating the facility commercially

to establish an enduring domestic supply of REEs and CMs? *None. Our Project will be a full-scale operation capable of continuing for the life of the Project: +40 years.*

B. RESEARCH AND DEVELOPMENT NEEDS

1. Are the extraction, separation, recovery, and refining technologies in your prospective facility ready for demonstration or is additional R&D needed? *Yes, all technologies currently operate and are proven at the commercial level. Our Project does not require further R&D.*

a. If additional R&D is needed: please answer the following:

i. Describe the additional R&D needed. *No additional R&D is necessary; however, ongoing optimization is budgeted.*

ii. Describe the cost associated with the additional R&D. *The ongoing optimization is budgeted and estimated at five percent (5%) of each unit operations annual budget.*

iii. Describe the schedule impact due to the additional R&D. *N/A.*

a. Provide your thoughts on whether or not the R&D could be performed concurrently with other steps to design, construct, or build-out the demonstration facility? *N/A.*

2. Based on where your technology readiness levels (TRLs)20 and technoeconomic assessments (TEAs) are for the various demonstration facility processing circuits at this time, please address the following: *For all technologies employed: TRL = 10. Currently operating at commercial scale. TEA = 10. Currently profitable at commercial scale. Note that metallic conversion, including magnetic materials, is not price-competitive against Chinese production due to various tax and internal cost & pricing advantages. However, our JV Partner is currently profitable: selling to mostly defense contractors and other customers with non-Chinese mandates.*

a. Describe what would be needed for the design, construction, and operation of a follow on commercial-scale REE and CM facility. *See description of Project in Item A.1 above. The primary obstacles to profitability and overcoming China's monopoly are the significant government subsidies and tax breaks China provides to Chinese metal, alloy and magnet producers that convert separated oxides into a metallic form before export. China's lower labor, capital and investor return costs, when combined with their generous subsidies, make the production of rare earth metals outside China non-competitive*[iv].

Without offsetting tax credits any U.S. magnet producer's sales would be limited to mostly defense contractors. No non-defense technology company can be expected to pay more for rare earth magnets[v]. *But more to the point, they will not be willing to give up the reliability and low-cost of Chinese magnets if there is <u>any risk</u> of supply interruption from a new supplier. China has a reputation for disrupting its non-Chinese rare earth customers and for harsh trade-reprisals for any action that offends China*[vi].

***Note**: our proposed full vertically integrated rare earth facility can off-set 100% of U.S. magnet imports (based on 2020 totals). However, without equalizing tax incentives against China's subsidies, U.S. and other non-Chinese markets may not utilize anything close to our full capacity*[vii]. *This is a risk for any domestic producer of metals, alloys or magnets. Please contact us if you are interested in proposed legislation designed to off-set these Chinese subsidies.*

b. Define commercial-scale, and what quantities of REEs and CMs would be produced at commercial-scale facility. *See description of Project in Item A.1 above.*

c. Please address what TEAs have been or will be conducted for the host site(s) and/or alternate processing circuit site(s) that you would propose. *See description of Project in Item A.1 above.*

C. LOCATION, COST, SCHEDULE

1. Related to facility location, please address the following:

a. What location(s) would you propose for a facility and why? *Our Project would be located in Missouri, U.S. incorporating a fully permitted resource production site for the management of mine waste and other deleterious material in conformance with all state and federal regulations and standards and a secondary downstream campus for separation, metallic conversion and OEM ready magnet production.*

b. How does that specific location or the surrounding region impact (positively or negatively) the building of the facility or accessing relevant feedstocks or supply chains? *The upstream mine site is the source of the rare earth ore. All necessary infrastructure is in place from past operations. The mine is in good standing with all environmental regulators, with no history of harmful discharge or emissions through its +60-year existence (largely due to the benign chemistry of the ore deposit). The mine site is in a remote rural area, with a significant downstream buffer (2,000 acres, or nearly 3 square miles) assuring that public exposure to waste and health issues are minimized. The downstream location, to be determined, will conform with local, state and U.S. federal standards and regulations. Note that each of our JV Partners currently operate in conformance with environmental standards within UK, France or Germany. The mine site and the Bridgton/Ferguson site qualified as economically distressed and/or underserved areas.*

Project Locations: The Project will consist of two facilities located in the same general geographic location: the Upstream and Downstream facilities. The upstream facility, the mine and mixed oxide production facility, will be able to accept and process deleterious resources like monazite and any other phosphate-based resources from any other rare earth mine. Any consequential thorium byproducts can be stored at the mine site, in conformance with state and federal regulations. The downstream facility will produce separated oxides, produce magnetic materials and other rare earth metals and fabricate magnets to OEM specifications on a single campus. The separation facility will be able to accept oxides derived from coal byproducts and/or coal waste products or from other conventional REE producers such as MP, Lynas or Blue Line.

Why are the Upstream and Downstream Facilities Separate?: The planned upstream facility, at the mine site, will produce rare earth concentrates from mine waste (tailings/unconventional feedstock) and convert that material into a mixed rare earth oxide. This facility will remove all deleterious materials and store them on-site, in conformance with state and federal law. Due to the magnitude of accumulated gang materials (reprocessed tailings) and the storage and management of other deleterious byproducts resulting from the new/reprocessed tailings-waste, it is impractical to conduct this work away from the mine site or in an urban area. Due to demographics near the mine site, local population and technical skill level, it is not possible to co-locate the downstream operations at the mine site. Consequently, only the mining and mixed oxide production will happen at the mine site in Sullivan, Missouri. The downstream separation of rare earth oxides, production of magnetic materials and fabrication of magnets will happen at one of the two locations, to be determined.

Downstream site selection will be influenced by access/proximity to skilled ready workforce, existing infrastructure, logistical advantages, price per acre, legacy environmental/remediation cost and the availability of large land-tracts sufficient to accommodate the combined footprint of the two facilities: separation, metallics and OEM magnet fabrication.

1. *Jefferson County: 750-acres of property, currently owned, on the Mississippi River in Jefferson County, Missouri. This property is 45 miles from the mine site and 35 miles south*

of St. Louis City. This property has excellent infrastructure (rail, river, interstate and electric service) and a proximate/local workforce.

2. *Ferguson/Bridgeton area[viii]: There is undeveloped acreage, near Ferguson, Missouri (St. Louis County) and this location is near our academic partner, the University of Missouri, St. Louis (UMSL). This property is co-located with the St. Louis International Airport. Industrial infrastructure is adequate and has a proximate area workforce (St. Louis County). Ready access to the international airport may prove favorable. This is an economically destressed community.*

c. What siting and environmental justice concerns have been considered? Please provide specific concerns, e.g., siting, transportation, exposure to waste from the demonstration facility, other public health impacts, etc. *Our Project has an active mining permit and TSF permit for the site. This Project will result in the creation of an estimated 1,500 direct and up to 10,000 indirect jobs[ix]. Direct jobs will include the creation of administrative and mining professionals, material processing professionals, skilled technicians, laboratory and metallurgical specialist, shipping, accounting, inventory, customer representatives, compliance, safety and multi-level management professionals. Indirect jobs will include the increased academic and technical staff at our University JV Partner, tech and trade-school education programs, outside laboratory & engineering support, extensive supply chains, logistics and transportation support, enhanced amenities for the local community and the potential of re-shoring REE dependent technology jobs and OEM users of other rare earth materials.*

d. Please identify all NEPA/environmental assessment(s) and/or permitting that has already taken place or is/are being conducted for the host site(s) and/or alternate processing circuit site(s) that you would propose. To the extent possible, please also identify anticipated upcoming environmental analyses and permitting actions. *Our Project has an active mining permit and TSF permit for the site. The location is subject to quarterly environmental reporting and annual inspections. The site is in good standing with all environmental and permitting agencies.*

2. Please discuss if your prospective facility would consist of processing feedstock materials through production of critical rare earth metals for alloying, at a centralized, vertically integrated location. If not, please describe your prospective facility's configuration and the rationale for its configuration. *Our Project would process REE ores into metals, alloys, OEM ready magnets and other REEs products as part of a unified, vertically integrated JV partnership. See above and description of Project in Item A.1 above.*

3. Related to schedule, please address the following: a. For a demonstration facility, please comment as to what you would consider as reasonable in regard to:

i. schedule, *See description of Project in Item A.1 above. We can provide a more detailed schedule if requested, but in short, the Project could begin the production of rare earth magnets in less than 3 years.*

ii. test duration, *See description of Project in Item A.1 above.*

b. What do you believe to be the specific critical path, including lead items or activities that will most influence the initial start-up of the demonstration facility? *The largest determining factor is timelines related to major equipment deliveries and potential construction labor shortages. DoE and other Federal support for this project will also significantly impact the success, timing and terms of private funding.*

4. Related to estimated costs, please address the following: a. Have you conducted an AACE Class 3 cost/schedule front-end engineering and design (FEED) study or approximate equivalent for a 1-3 t MREO/day or similar size demonstration facility? *Our cost estimate is not for a demonstration facility. For our Project, each JV Partner is currently operating a commercial scale facility so engineering will be limited to replication and scaling. Class 5 and Class 4 cost estimates are complete and a Class 3 cost estimate is in process. The $2.5 billion budget is based on the current Class 4 cost estimate.*

If so, please comment on the cost and time to conduct the FEED study and its results, including the projected cost for a full-scale demonstration facility. *Approximately $2.5 billion for our Project.*

b. What should be the Rough Order of Magnitude (ROM) cost estimate (capital and operating expenditures) for your prospective demonstration facility? *Approximately $2.5 billion capital costs ("**Capex**") for our Project. Operating cost estimates ("**Opex**") have not been completed at this time and are ongoing. Regarding the resource for our Project, all primary minerology and hydrometallurgical work is completed. High purity mixed RE oxide production, along with multiple byproduct refinement work, has been completed. Engineering will be limited to the refinement of proven/off-the-shelf RE oxide concentration processes and optimization. All final engineering will conform with AACE or equivalent engineering and cost standards.*

Please include a description of the assumptions used as a basis for the ROM. *Factored and take-off estimates are in accordance with AACE standards based on markets.*

c. What is your estimate for the cost of construction work for each stage of development and integration especially if you commented previously that you felt an intermediate scale facility was needed? *N/A.*

D. EQUITY, ENVIRONMENTAL, AND ENERGY JUSTICE (EEEJ) PRIORITIES AND COMMUNITY ENGAGEMENTS, BENEFITS, AND IMPACTS.

Response to Section D. Items 1. To 5: Regarding DoE and Administrative goals for Disadvantaged Communities and Justice40: Forthcoming feasibility studies will incorporate all issues related to Justice40, workforce education and training pathways, economic impact on the local, regional, state and national economy, environmental and economic justice, impact on disadvantaged communities, union labor opportunities, financing, permitting, safety, partnering agreements, power purchase agreements, long-term sustainability and minimizing economic and environmental risks including meeting all applicable Section 822(a) requirements and obtaining/identifying land use rights and site access, and identify permitting and regulatory requirements (all standard for feasibility studies of this nature).

The establishment of this Project and working with our academic JV Partner will conform with the following DoE/Administration goals: increase the clean energy job pipeline and job training for individuals; increase clean energy enterprise creation and possibly result in the re-shoring of RE dependent technology companies. Also, processing rare earth ores and concentrates at the mine site will decrease environmental exposure and burdens for the community near the downstream facility.

However, the primary focus of our Project is to establish a business venture for the production of critical materials that can compete against China's state sponsored monopoly. This Project must compete with a state sanctioned monopoly that provides tax credits and other subsidies to control REE and other critical materials as part of a geopolitical strategy to obstruct the U.S. (and the

rest of the world) from participating in the rapid transition to EVs and green technologies (and securing our national defense needs).

Furthermore, China has the most successful STEM program in the world and at least 5 National Labs that directly support rare earth basic, applied, chemical, material and commercial sciences (the U.S. has one National Lab, Ames, that does REE as a side-project -- at best[x]). China also has dozens of industrial, commercial and rare earth trade organizations that enjoy substantial state support[xi].

In addition to all of these challenges, the Chinese government continues to consolidate its rare earth mining industry to manage its global monopoly over the production of separated oxides, metals, alloys and magnets (and other critical materials).

Consequently, as stated above, we can only commit to working with our University JV Partner and regional high schools and trade schools to develop job training programs, technical and professional education programs and focused STEM programs for the underserved communities in the area. This would include a focus on the creation of equitable, high-quality jobs that are family sustaining in highly-impacted communities.

Our University JV Partner is ranked nationally in the top 100 for K-12 Career Pipeline Programs, Social Equity, Workforce Training and many other equity and work-force program for the underserved. As these programs will be designed to serve our own staffing needs, they will be measured by our success. Our stated commitments are in-line with our social responsibilities and will resolve pressing national security concerns.

E. TARGET MARKET, BUSINESS MODEL, AND PARTNERSHIPS

1. Describe what permits, licenses, or intellectual property rights are in place or are needed to build and operate a REE demonstration facility. *Construction, SWPP and air quality permits are outstanding at this time (and issued based on submission of engineered construction plans). All other permits, licenses, and intellectual property rights are in place that are needed to construct and operate the upstream portion of the Project. All downstream technology and processes currently operate in permit environments equal to or in excess of local, state and federal standards (with facilities currently operating in the UK, France and Germany). All targeted communities and the State of Missouri have expressed strong support for this Project.*

2. Please describe your organization's Financial/Business Model for capital financing and the ongoing economic production of 1-3 t MREO/day and conversion to refined materials at the intended quality and/or purity. State intended quality and/or purity targets. *Approximately $2.5 billion capital cost for a 10,000 tpy RE oxide Project that can produce approximately 6000 tpy of standard and high-temp OEM ready magnets (approximately equal to 2020 RE magnet imports). Details Follow:*

Rare Earth Element and Magnet Production (Start Date: 2025):

Phase 1 Design Capacity - 10,000 tpy of +99.5% RE Oxides for the following Products:
NdFeB Magnets,
SmCo Magnets, and
RE Metals, Alloys and other products

By Target Element:

Nd: 1,500 tons per year
Pr: 400 tons per year
Dy: 220 tons per year

Tb: 40 tons per year
(Equating to about 6,000 tpy[xii] of mostly high-temp NdFeB magnets), and:
Sm: 300 tons per year
Co byproduct[xiii]: 25 tons per year of a
(Equating to about 30 tons per year of SmCo magnets)

Approximately Equal to 100% of U.S. Rare Earth Imports / Demand[xiv]

3. Regarding required cost share, please address the following: a. As discussed in Exhibit 2, cost share for the demonstration facility is anticipated to be 50%. Please discuss your ability or inability to cost share 50% of your proposed demonstration facility. If you believe that 50% cost share is not achievable, what cost share percentage do you believe is reasonable/achievable? *The Project currently anticipates obtaining most of the $2.5 billion capital cost from a combination of private sector equity and syndicated debt financing for the Project. Assuming our Project was awarded the entire $140 million from the FOA, the DoE's contribution would be less than 5% of the total cost. Additional DoE/Federal financial support would greatly benefit the advancement of this Project and help ensure beneficial terms from private funding sources.*

b. Describe how you would provide/allocate your cost share and how any borrowings would be repaid, if applicable. *DoE and Federal government funding at levels greater than the potential $140 million would improve the attraction/involvement of Investors from the private sector in our Project. Our financing goal is to maximize private equity financing and DoE/Federal grants. Any debt would be paid out of earnings. A well-structured financing would allow each of our JV Partners to partially participate in their own JV-Unit and shared-unit profits and allow for allocation of a significant portion of earnings to a publicly traded company that could reward private investors.*

4. Please clearly articulate, with concrete actions, how regional economic growth and its benefits will be shared with underserved populations. *The Project will require various levels of skill sets. These will consist of unskilled, semi-skilled and highly skilled employees. Underserved populations will have priority access to positions based on partnership training programs. The highly skilled positions will require college education and/or higher degrees of education. The Project is teaming with University of Missouri JV Partner to provide training to candidates from underserved communities. Our University JV Partner, operating in the Ferguson/Bridgeton Missouri area, is ranked in the top 100 for K-12 Career Pipeline Programs, Social Equity and Workforce Training programs. Each of our JV Partners will co-develop tailored work-force programs with the University JV Partner. The mine site is located within a federally designated Distressed Middle-Income Nonmetropolitan Tract (Washington County, MO Tract # 4602.00). This project would make the selected downstream location the center of knowledge and production of critical materials for much of the non-Chinese world. The potential for re-shoring REEs dependent industries near the downstream campus would radically change the opportunity pathway for the regional populations.*

5. Please comment on your Business Plan with respect to the sale and distribution of the REE and CM materials that are produced in your facility. If these materials are sold during the project period, do you have a preference for how the program income would be allocated back to the project (e.g., addition, cost share, or deduction)? *Because this is a fully integrated project, our OEM Magnet JV Partner would sell the majority of finished product directly to existing (or re-shored) customers. Income will be used to potentially 1) pay operating expenses, 2) pay off loan obligations, 3) create operating reserves, and 4) pay ownership profits.*

6. Regarding supply chains and byproducts, please address the following:

a. Please comment as to what supply chains you expect will be supported by such a REE demonstration facility. Please identify any customers or customer classes (e.g., magnets, electronics, batteries, etc.). *See Section A.1, etc. Our OEM Magnet Fabricator JV Partner currently supplies, and will supply via this JV, all end-user industries, including EVs & traditional automotive, telecommunications, industrial, aerospace, electronics, audio, computing, systems control and the U.S. defense industry.*

Provide information on any market studies conducted that demonstrate a viable demand for REE demonstration facility products. *Not completed yet, however, our OEM Magnet Fabricating JV – Partner currently sells into all REE magnet markets and is best suited for this responsibility.*

b. Do you expect that products other than REE or CM will be produced from the feedstock(s) used in your prospective facility? *Yes.*

Will these be outputs of your facility, and have/will you find markets for such products? If so, please explain. *Our pyrite byproduct will be sold to a regional facility and the extracted cobalt will be returned to the Project for the production of SmCo magnets. Other byproducts could include, but not be limited to, phosphates (for fertilizer), chemical grade iron oxides and the nickel, copper and molybdenum that are also contained in the pyrite.*

c. Have you considered the economics/value of producing metal vs. producing separated rare earths and critical minerals that could be sold to an off-taker who already has commercial facilities to highly refine those separated products and to manufacture products (e.g., a magnet manufacturer)? *Yes.* If so, please discuss. *Our business plan is to produce OEM ready magnets, metals, alloys and other REE products.*

7. As it relates to partnerships, please address the following: a. Have you established partners/relationships needed to achieve the vision of a primarily U.S.-sourced REE and CM industry? *Currently in negotiations and potentially contingent upon DoE FOA funding.*

b. Please comment on your ability to design, construct, and operate the demonstration facility using domestic entities (organizations incorporated or otherwise formed under the laws of a State or territory of the United States). *The Project will be designed, constructed, and operated using domestic entities. All of our JV Partners are aligned-foreign corporations. Some currently have U.S. operations. All would be required to establish new U.S. corporations specific to this JV partnership. All have previous operating experience which ensures that the Company/Project has the capabilities to complete all of the necessary steps. As the relevant technologies, separation, magnetic materials and OEM magnet fabrication are all controlled by non-U.S. entities, the DoE FOA must allow for foreign participation.*

c. Please identify all partners (e.g., industry, academia, government, etc.) that would be part of your team. Also address: *See Section A.1 for information regarding the technology partners.*

i. Are Minority Business Enterprises and Minority Serving Institutions engaged; and if so, what role do they play? *Yes. Our University JV Partner is a Minority Serving Institution on many levels.*

ii. Are foreign entities required, and if so, what role(s) do you propose they have? *Yes, they will operate facilities located in the U.S. as U.S. enterprises.*

a. Would these partnerships facilitate entry into either/both domestic and international supply chains? If so, please discuss. *Yes. Our Magnet Fabricator JV Partner currently*

acts as a supplier to many national and multi-national technology companies. Our Magnetic Materials JV Partner makes other essential REE metals and alloys for multi-national technology companies. Our Separation JV Partner is the only non-Chinese producer capable of separating all 16 commercial REEs and selling them internationally (Pm is not a commercial REE).

iii. Please discuss the roles and functions of all participating industry(s), and how you would implement your full vision for the design, construction, and operation of the demonstration facility to include these industrial participants. *See Section A.1 for information regarding the technology partners.*

iv. Please describe your existing partnerships with organizations performing remediation and/or reclamation, and the potential users and use of the products or waste streams from the demonstration facility. *Our initial REEs production will be from the reclamation of a formerly abandoned tailings impoundment. The reclaimed products will be rare earths, phosphates, iron ore and other technology metals (contained in the pyrite).*

v. What is the expected role of the BIL-required academic partner (such as a prime or subrecipient/subcontractor)? *Assist in training/skillset development for the purposes of furthering R&D and to guide execution of Justice40 and other social equity programs.*

d. Do you envision foreign national participation will be needed for your organization or any of your partners in the design, construction, and operation of the demonstration facility including, but not limited to, the integration of conventional separation through refining and alloying technologies, advanced technology development, design and configuration of reactor systems, process circuit operating parameters, facility operation, and market and supply chain assessment? *Yes. See Section A.1 for information regarding the technology partners.*

i. If so, please discuss and, at a minimum, address what role(s) you propose they will have. NOTE: DOE concurrence may be required before a foreign national can participate in the performance of any work under an award. A "foreign national" is defined as any person who is not a United States citizen by birth or naturalization. *In short, our JV Partners own and control the IP, technology support, and rare skillsets necessary to produce separated REEs, metallic and magnetic materials, and OEM ready magnets. See Section A.1 for information regarding the technology partners.*

F. IRON, STEEL, MANUFACTURED PRODUCTS, OR CONSTRUCTION MATERIALS AND CLEAN ENERGY JOBS

1. Does any of the work for which you expect to apply for DOE Financial Assistance involve the construction, alteration, maintenance, or repair of any of the following:

a. Roads, highways, and bridges; *Minor updates to local infrastructure.*
b. Public transportation; *Potentially.*
c. Dams, ports, harbors, and other maritime facilities; *No.*
d. Intercity passenger and freight railroads; *Yes.*
e. Airports; *No.*
f. Water systems, including drinking water and wastewater systems; *Yes.*
g. Electrical transmission facilities and systems; *Minor potential.*
h. Utilities; *Yes.*
i. Broadband infrastructure; *Yes.*
j. Buildings and real property. *Yes, new construction.*

2. If your answer to question 1 is yes, please identify any iron, steel, manufactured goods/products or construction materials which are crucial to this work, and whether you would normally procure those items domestically or from a foreign source. *Iron and steel for structures – can be exclusively procured from domestic sources. Major processing equipment – most likely from foreign sources.*

3. For any item you indicate that you would normally procure from a foreign source, please specify to the best of your ability whether you would avoid seeking to procure these items domestically due to lack of availability or cost. *Yes, both.*

4. In what ways, if any, do you anticipate a REE demonstration facility project could impact your workforce? For example: a. To what extent do you anticipate job creation or changes in job quality? *There will be significant impacts on job creation as the mine site the downstream sites. The mine and one of the downstream sites are economically disadvantaged and underserved. Our Project has the potential to fundamentally change the economics of the upstream and downstream facility locations and potentially re-shore rare earth dependent technologies. Our Project may also allow many multi-national technology companies to develop REE dependent IP that they are currently withholding from the market: to prevent China from gaining access and control over it.*

b. To what extent do you anticipate the creation of construction jobs? *There will be a significant job creation in construction jobs, especially if our project attracts new and re-shored REE dependent manufacturing facilities.*

Non-construction jobs? *There will be significant potential for job creation.*

5. Would you consider working with local coalitions to find ways to match regional workforce resources with hiring needs? *Yes.*

G. OTHER

1. Please provide feedback on DOE's vision and approach shown in Exhibit 1 and Exhibit 2. *There is a major disconnect between the Administration's EV goals and the DOE plan to provide resources to EV manufactures to meet the Administration's goals. Based on the timeline as proposed in the DOE RFI, the U.S. will not be able to support U.S. EV manufactures needs for REEs magnets (and other REE based components) required for EV production (and other green and defense technologies), and they will remain at the mercy of the Chinese. This Project solves this major disconnect.*

2. Please discuss what would be viewed by industry as success criteria for design, construction, and length of time for operation of the demonstration facility. *Fully operational facility in three years.*

3. Please describe any issues that should be addressed to enable the implementation of the Rare Earth Element Demonstration Facility under Section 40205 of the BIL including the following:

a. Legal, *None.*
b. Regulatory, *None.*
c. Policy, *None.*
d. Environmental justice concerns, *None.*
e. Other. *None.*

4. Provide any other comments or information that you feel are important/relevant, but that are not otherwise covered here, including any other questions you have that would need to be

answered to enable the implementation of the Rare Earth Element Demonstration Facility under Section 40205 of the BIL.

1. *It is important that the DoE allow foreign technology companies to participate.*
2. *It is also important for the DoE to leverage any other federal funding towards the startup- financing of this Project to assure its rapid development.*
3. *The DoE must recognize the domestic production and timeline disparities of the FOA relative to this Administration's goals. DoE production goals do not coincide with anticipated rollout of EV and other green tech developments. The DoE's 2035 and 2040 RE production goals of 10 and 20% of U.S. demand leave China in the commanding position over EVs and other products long past the growth phase of the market and even into the early stages of market maturity. Consequently, we strongly recommend the DoE funding of a project capable of rapid commercial scale production of OEM ready products.*
4. *Just building U.S. RE magnet facilities dose not solve any problems without adequate domestic Tb / Dy production capabilities, as China will retain control over all high-value high-temperature magnets – leaving the U.S. facility to produce low value magnets that cannot match Chinese pricing and are incompatible with critical EV and defense applications* [(see iii,& iv)].
5. *Just building RE magnet facilities dose not solve any problems without vertical integration (allowing for internal price transfers) and / or tax incentives (or some other consideration) to off-set Chinese subsidies and internal cost advantages*[(see iii)]. *Production volumes would be limited to defense contractors and companies with 'no-China' mandates, leaving all international technology firms in the hands of China.*

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[i] The lead applicant has also submitted an RFI response to the DoE's FOA 0002664 for the rapid development of a commercial scale Hydrogen to Green Steel facility. The projects are co-related, as reopening the underground mine will provide access to the iron ore and underground rare earths (120,000 tons of REEs are already on the surface, in the TSF).

[ii] Promethium, Pm, is not recoverable from the earth's crust and is not used commercially.

[iii] Based on Chinese subsidies and other internal cost advantages no non-Chinese producer of metallic materials can be competitive with Chian. In a 2019 report we prepared for the Pentagon we interviewed one of only 3 rare earth magnetic material producers operation outside of China. The magnetic material producer stated that the scope and scale of China's internal tax credits and other inter-country discounts that make Chinese produced metals and magnets cost about 20% less than any non-Chinese producer can make them. This was confirmed by the Japanese government, in the same report. In fact, the Japanese government directly informed our government they had terminated all domestic new (smelted) rare earth metal production in 2018. The reason stated for ending all production of new metals was *"rare earth prices are determined by China"*. If the U.S. wants to be independent of China's RE monopoly they will need to provide tax credits for the production of RE metallics and magnetic materials or some other consideration.

[iv] Other advantages were detailed in the DoE's recent "Deep Dive" report, as follows: *"The advantages of producing in China has also been made evident by the fact that established magnet producers, such as TBA[d], Shin Etsu, TDK, and Vacuumschmelze, have recently established production facilities in China. The availability and stability of supply of rare earth metals in China has been a key driver of this shift. Reduced export quotas and a temporary cut-off of shipments of rare earths from China to Japan, as well as the resulting price differentials between REs for Chinese and non-Chinese buyers, led producers from outside China to be concerned about the stability of RE metal supplies. China also manufactures equipment to manufacture magnets that is about one-third to one-half the cost of Western equipment.*

[v] The only thing more important than the price of a finished magnet to an OEM/off-take customer is uninterruptability. Currently every magnet producer in the world remains 100% dependent on China for Tb, Dy, ect..

[vi] For example, China has cut off U.S. and other end-user of rare earth products for various reasons. Large companies like Siemens have established multiple straw-man buying companies to assure supply (and conceal internal usage of REE). In 2016 the top lobbyist for a large U.S. defense contractor refused to provide any level of

support for proposed rare earth legislation, stating *"even if you put me in the room (a SASC committee meeting) China can get to us"*. In another instance, a U.S. company testified about China and REE before the House Committee on Foreign Affairs in 2011. Shortly thereafter China disrupted shipments to the company for a period of two years. The company was forced to the edge of bankruptcy and is no longer willing to speak on the topic. China has even established guidelines for cutting off U.S. defense contractors. *"In a November report, Zhang Rui, an analyst at Antaike, a government-backed consultancy in Beijing, said that US weapons makers could be among the first companies targeted by any export restriction. China's foreign ministry said last year it would sanction Lockheed Martin, Boeing and Raytheon for selling arms to Taiwan, the self-ruled island that Beijing claims as its sovereign territory."*

[vii] This could severely constrict investor's willingness to build out production capacity to our desired target level of 6,000 tpy of domestically produced rare earth magnets (approximately 100% of 2020 import levels).

[viii] The Ferguson / Bridgeton area is attractive because we have as strong relationship with local university, UMSL. There are also large real estate tracts available. Access to the international airport may prove beneficial. The Ferguson/Bridgton location provides excellent access to our university partner and St. Louis population. Ferguson is located in St. Louis County, away from the river, so logistics cost for bulk processing materials would be higher.

[ix] Using a standard 7-X multiplier.

[x] It is undefendable to claim that Ames Laboratory is anything more than a placeholder for rare earth research. How else do you explain the relative decline of the U.S. in this space. For example, China files about 35 rare earth patents for everyone filed in the U.S. China has accumulated more rare earth patents than the rest of the world combined. China began operating the largest rare earth research institute in the world in 1985 and has established at least 4 others. China has at least 200,000 PhD / scientists working exclusively in the field of REE. For a complete list of Chinese accomplishments, mostly at the hand of U.S. companies and our government, please see: chiarepatent.pdf (threeconsulting.com) .

[xi] Unlike China, the non-Chinese/Western *rare earth industry* is adversarial in nature. These technical and resource challenged mining companies (incapable of full elemental separation and deficient in heavy REEs) operate in a market defined entirely by China (where China is ultimately the primary or only customer). The defining calculus of these Western companies is ultimately reduced to seeking investor patronage: stock price. To believe otherwise is contradictory to the nature of publicly traded companies and history (all of China's REE capabilities were transferred to it by Western companies looking to boost profits and/or off-shore environmental risk). Examples of this are the iPhone (seeking access to REE resources) and the auto industry (seeking markets), but for different reasons. Post 1970, it has become the legal obligation of publicly traded companies to seek profit by any legal means (and increasingly by illegal means – knowing that the risk of being caught and fined can be calculated into the risk / reward ratio as a 'cost of doing business').

[xii] Total U.S. imports of NdFeB and SmCo magnets totaled around 6,000 tons in 2020. However, a new report by the DoE, the so-called "Deep Dive" report listed total NdFeB magnet imports at 16,100 tons. That total included imported products that contain rare earth magnets like cell phones, computers (with hard drives) and other electronics.

[xiii] The tailings reclaim Project will also recover about 600,000 tons of pyrite containing Co, Ni, Mo and Cu. The pyrite will be toll-processed by Missouri Cobalt and the Co values will be transferred to TBA[c] for the production of SmCo magnets (and the other valuable byproducts will be sold).

[xiv] The DoE RFI metric provided was "1-3 t/day or ~360-1000 t/yr is ~10% of the 2019 U.S. demand, which is the production basis used in DOE FECM-NETL's RFP.