Pea Ridge REE / Tails Mining Project

A Multi-Product Reclaim Project

Washington County, Missouri, USA
February 2021

Economics of the Pea Ridge REE Project

The economics of the Pea Ridge Rare Earth Distribution are superior to other operating / late-stage 'western' REE projects.

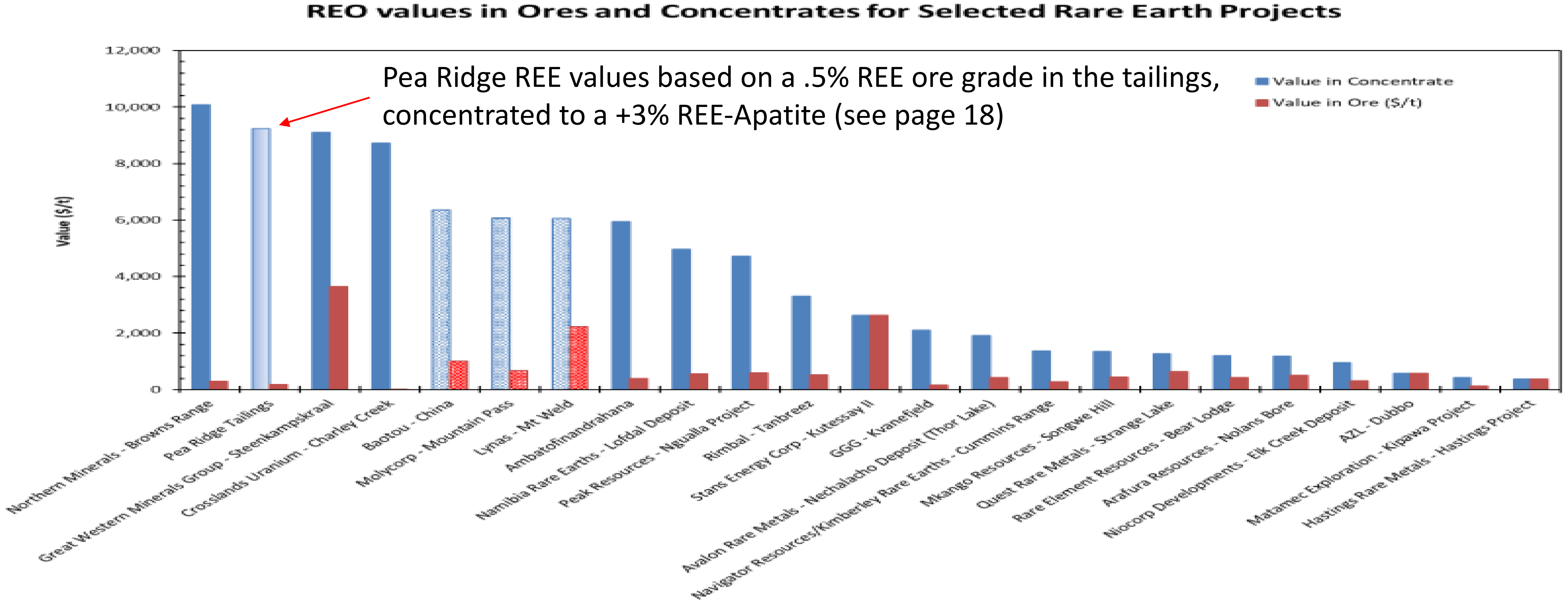


Figure 2: REO Values in Ores and Concentrates for Selected Rare Earth Projects

Ownership and Permitting

The Pea Ridge mine property and mineral rights are undivided and held by Caldera Holding LLC (100% owned by James Kennedy and Nina Abboud).

The mine property has an active mining permit (MO #007T).

A recent letter (1.1.21) from the Missouri State mining regulator states that:

> Tailings reclaim/mining can proceed prior to updates to the mine closure-plan and notes that water, dam and air permits may also be required.

Caldera has a current dam and water permit (the water permit will need to be updated), but will need to apply for a State of Missouri air permit that is specific to air quality impacts related to the reclaim facility (not mining).

The Pea Ridge mine has no material outstanding environmental issues.

The State of Missouri's political and regulatory environment is pro-mining.

Because this is a reclaim project, relative engineering, permitting, developmental and production costs & risks are significantly reduced.

The REE Project economics are positive when evaluated on traditional hydrometallurgy processing costs or the Less-Cost model.

> The Less-Cost model utilizes the actual cost of mining, concentrating, refining and separating of rare earths, as reported by Lynas, across the distribution of any ‘western’ project being evaluated.

The favorable distribution of heavy REEs contributes close to half of the total rare earth values in the tailings.

Gross Value of REEs Based On Sulfuric / Hydro-metallurgical Process Cost

Based on SGS measures, the recoverable per ton gross value of REEs in the tailings is currently around \$80 per ton, or \$1.9 billion gross (1.5.21 pricing).

The SGS report suggests that the cost related to traditional sulfuric /hydrochloric based hydrometallurgical processing of the REEs would equal about 50% of their value, or \$960 million from recoverable REEs.

The hydrometallurgical costs may be reduced 20% or more through the utilization of a phosphoric acid leach / digestion process (see page 18).

> The phosphoric process also allows for the co-production of phosphoric acid, with an added net value of \$400 million.

Comparative Estimated Income on the Less-Cost Model

The Less-Cost model uses $10 per kg as the mining, milling, refining and separation cost for any ‘western’ REE distribution being evaluated.

> Based on industry estimates, Chinese value chain production cost are 30% lower. These lower costs are applied to other Asian and African producers feeding China’s REE value chain in the graphics that follow

The Less-Cost model does not assign any cost advantage to this project, such as lower mining, milling or processing cost, reduced OPEX and CAPEX derived from the utilization from phos-acid hydrometallurgy or the economic contribution of other valuable co-products.

Less-Cost Gross / Net Income Estimates

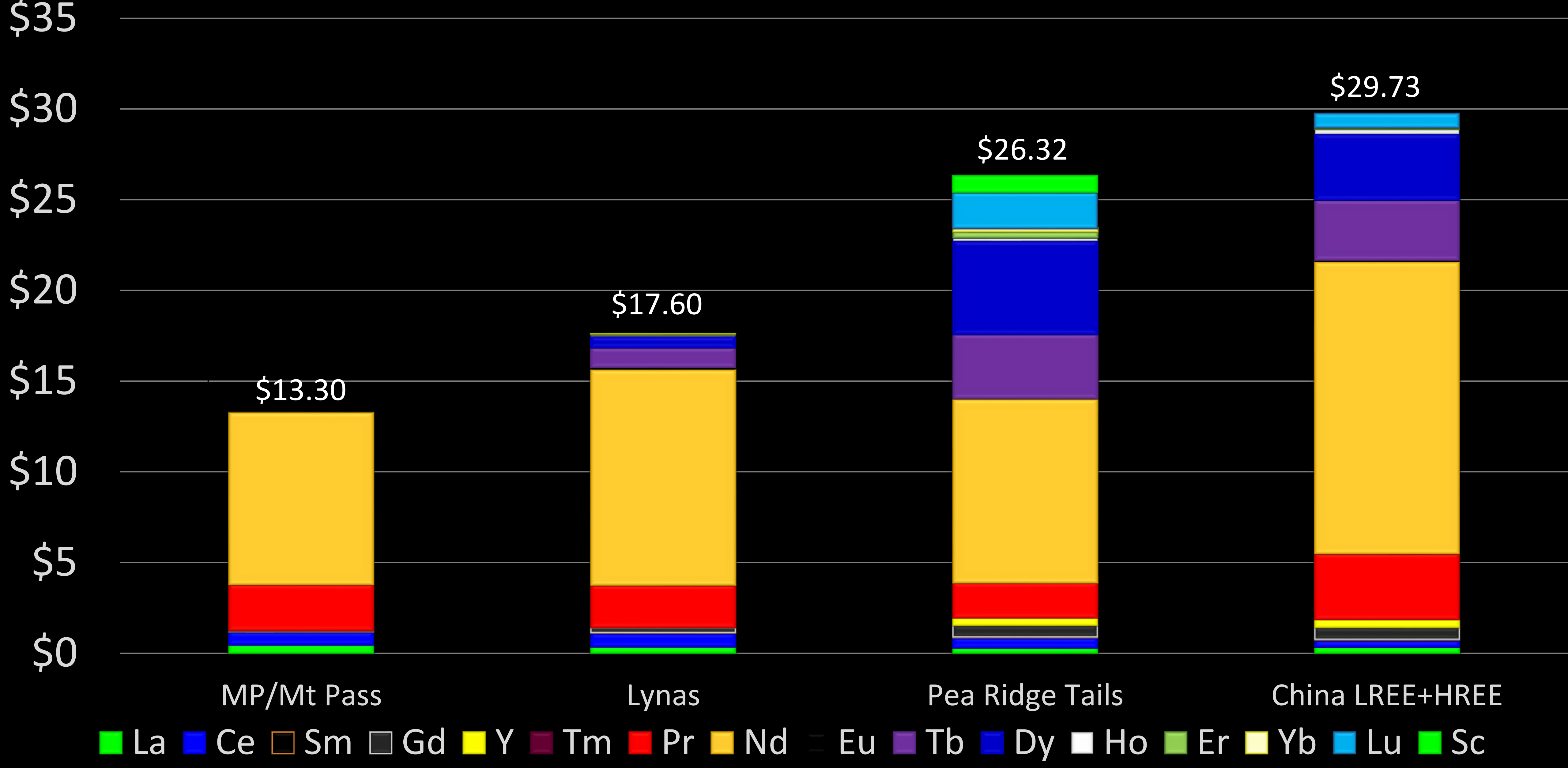
Based on the Less-Cost model, the Pea Ridge tailings have a gross basket-value of $26.32 per kg and a net-value of $15.78 per kg, multiplied by 60,000 tons of recoverable REEs, equals $1.5 billion gross and $950 million net income.

> The Less-Cost method applies the demonstrated cost of a 'real world' western producer to other projects, including the cost of mining, processing and refining (or discharging) non-economic elements like La, Ce, Sm and Y.

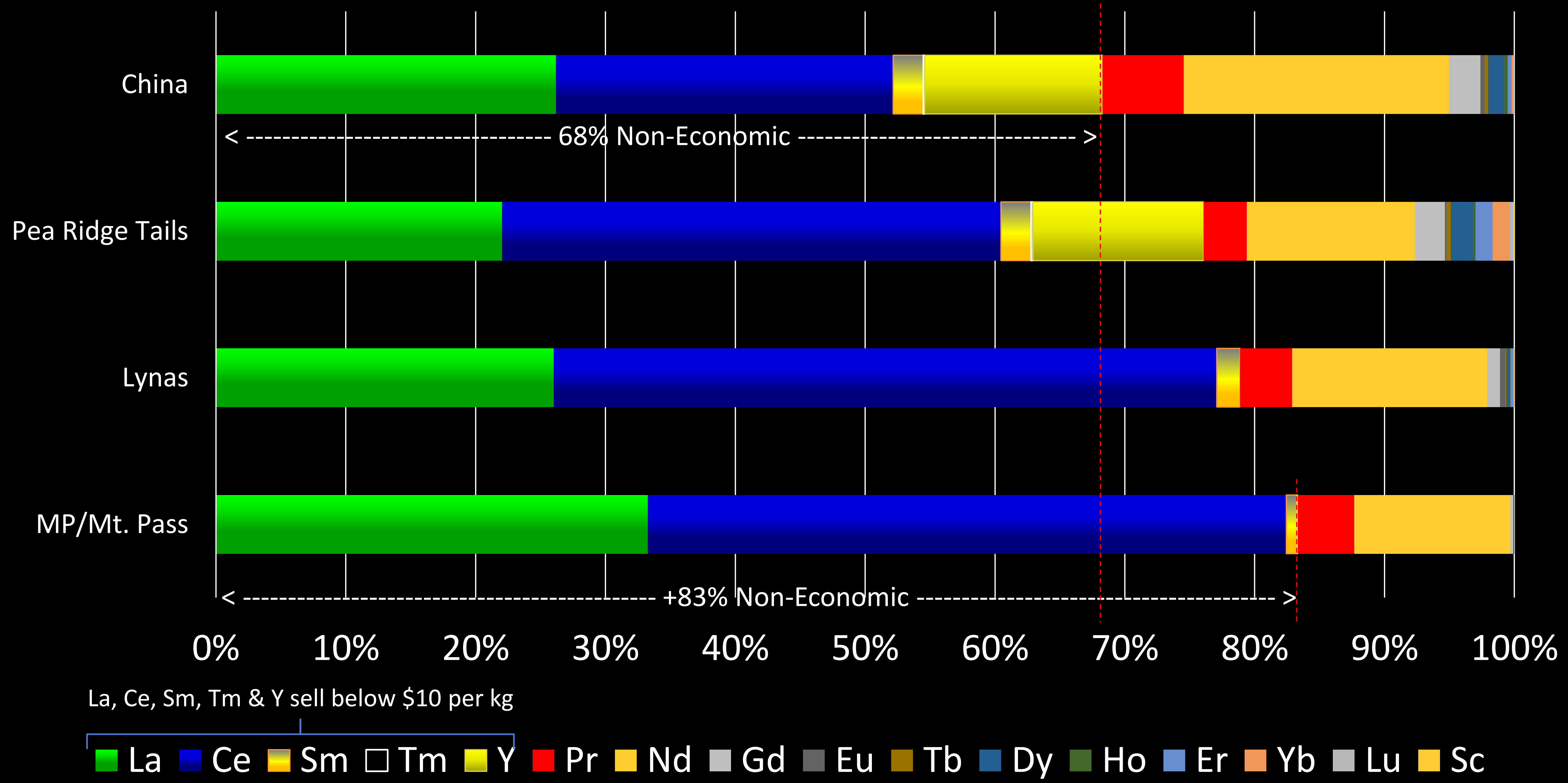
The following graphics demonstrate the hidden cost of processing non-economic elements relative to the overall distribution of more valuable REEs.

Gross REE Distribution Value by Producer

"Basket REE Values" based on published 1.5.21 prices

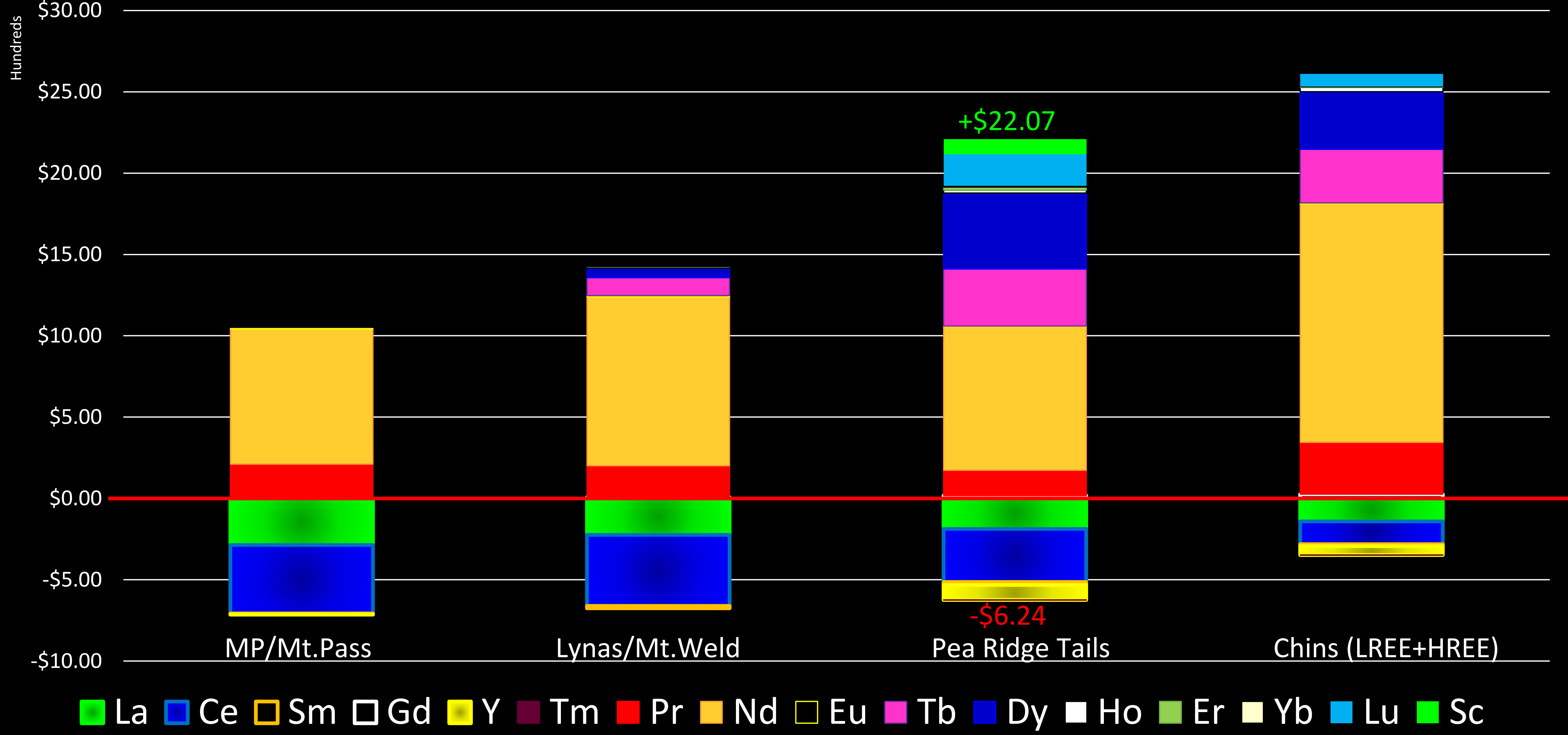


Proportion of Non-Economic REEs by Producer



Less-Cost Net Economic Value Across REE Distribution

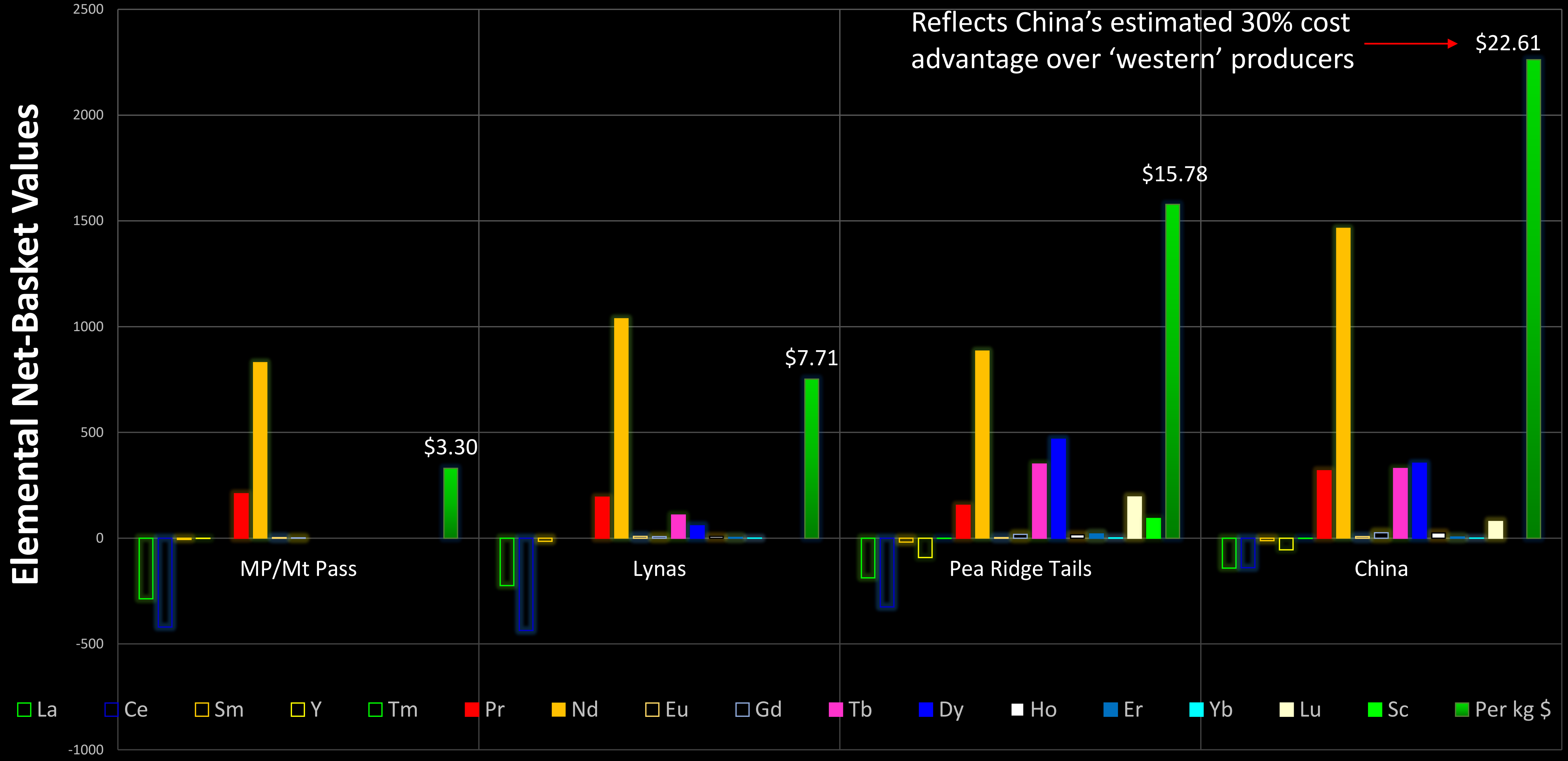
Based on $10 per Kg Cost for all REEs



Net-Economic Value Based On REE Distribution For Each Producer

Assumes $10 per kg charge against all REEs

1. 5. 2021 Pricing (Asian Metals)



Relative Processing Cost for REE-Apatite Concentrate

On a comparative basis, all of the mining and pre-processing cost necessary to produce a REE-Apatite concentrate are on par or much lower than the direct mining and beneficiation cost of other REE producers.   For example:

- Minimal mining costs
- No crushing costs
- Very limited milling cost (95% less)
- Limited infrastructure development cost

To produce a clean REE Apatite, it is necessary to first remove all pyrite and iron. Modest gravitational, sizing and mechanical process costs will produce a saleable hematite & magnetite product. Additional values can be extracted from the pyrite, including Co, Cu, Mo & H_2SO_4.

Pea Ridge REE / Multi-Product Reclaim Project

The Pea Ridge reclaim project is a multi-commodity recovery project.

By targeting the recovery of all primary mineralogical and elemental constituents, the total value of the project may exceed $3 billion in gross revenues.

Recoverable rare earth oxide values are close to $2 billion (gross).

The value of all other targeted products may exceed $1 billion (gross).

The recovery and beneficiation of targeted byproducts adds very little additional cost, resulting in high margin products.

Additional beneficiation of tailings underflow & Phos-REE Hydrometallurgy may result in the following co-products:

- +3,000,000 tons of 65 Fe Hematite
  Gross Value: $450,000,000 as **Oxide**, $525,000,000 as **DRI**
- 700,000 tons of chemical grade Magnetite
  Gross Value: $210,000,000 to $750,000,000
- 500,000 tons of Pyrite containing S, Au, Co, Cu, Mo & Sc
  Gross value may exceed: $100,000,000
- 1,000,000 tons of 56/58% Phosphoric Acid
  Gross Value: $400,000,000

Processing the P, Fe, S, Co, Cu, Mo, Sc values may exceed $1 billion in additional value. There is significant up-side profit potential in milled and sized high purity Fe3O4 products.

The estimates assume the following product options:

Hematite as an:

- ✓ Fe oxide product at \$150 per ton (current pricing ~ \$190)
- ▪ or DRI product at \$250 per ton

Magnetite milled into various high value products, such as a:

- ✓ Water purification chemicals - \$300 per ton (+10 microns)
- ▪ Pigment / abrasion products - \$500/\$700 per ton (-10/-3 microns)
- ▪ High purity Fe chemicals - \$2,000 per ton (-2 microns)

✓ Phosphoric Acid at \$400 per ton

Metallic values from Pyrite, including Co, Cu, Mo, Sc at:

✓ \$200 per ton from Pyrite

Total Estimated Income using low-end estimates

Gross REE revenues are estimated to be $1.5 billion.

Utilizing a phosphoric acid hydrometallurgical process will result in:

- A phosphoric acid co-product with a gross value of $400 million and reduced overall hydrometallurgical OPEX and CAPEX costs

Other reclaim byproducts include:

- Hematite with a low-end gross value of : $450 million
- Magnetite with a low-end gross value of $210 million
- Metal values in the Pyrite with a gross value of $100 million and
- H2SO4 from pyrite, lowering hydrometallurgical OPEX costs

Low-end Estimates: Total income may exceed $2.5 billion

Net Income Estimates

Using the SGS or Less-$10 cost method, net income from REE production comes in at around $950 million.

Assuming a 10% cost of production, the phosphoric acid product would net $360 million

Assuming a 20% cost on hematite and 10% on magnetite products, their low-end net income contribution may exceed $550 million.

Assuming a metal extraction markup of 20% following the H2SO4 process may result in net income of $80 million.

Estimated Total Net Income: ~ $2 billion

Estimated life of project: 7 to 10 years

Net Income Estimates do not include:

- Potential 20% hydrometallurgical savings from phos-acid process
- Potential 8% savings from self-generated sulfuric acid
- Potential 2% savings due to reduced infrastructure development, mining, milling and elimination of crushing costs
  - ➢ Potentially adding $250 million in additional income
- Expanded margins from high purity -10 and -2 micron magnetite products
  - ➢ Potentially adding up to $350 million in additional income

    Assumes 25,000 tpy -10/+2 and 25,000 tpy -2 micron product

Other Considerations:

As a consequence of processing the tailings the concentration of F and S in the process water will increase substantially. Any discharge of this process water will trigger environmental enforcement action. To prevent any such action it will be necessary to process and extract the S and F from the water.

The S can be converted into process acid.
The F can be converted into a potential product, such as silicon-fluoride

> From the SGS Report: Production of fluoride precipitate by reacting the PL liquor with sodium chemicals (such as NaCl or NaSiO3). Preliminary test work showed that around 70% of the fluoride contained in the PL liquor could be precipitated into a compound assaying 53% F and 14.7 % Si. Removal of the fluoride ion in the PL liquor should lead to a lower fluoride content in the final RL liquor and may have benefits in terms of material of construction requirement due to the very corrosive nature of acidic liquors containing high levels of fluoride;…

The objective for any such system would be to eliminate environmental issues and cover costs.

NOTES on Phos-Acid Hydrometallurgy: From Arafura's flow sheet & pilot test work on a phosphate hydrometallurgical process vs. hydrochloric or sulfuric, demonstrating a 20% reduction in hydrometallurgical costs

Table 2: Comparison of Capital and Operating Costs

	Hydrochloric Acid Pre-Leach	SAPL-DSP	PAPL
Capital Cost, A$M	1,912	1,408	1,006
Operating Cost			
A$/kg NdPr Oxide	64.93	57.88	48.43
US$/kg NdPr Oxide less Credits	47.31	43.75	25.94

Evaluating the metrics presented in Table 2 clearly demonstrates the economic effectiveness of the PAPL flowsheet in processing the Nolans ore.

Comparison of the hydrochloric acid pre-leach and PAPL costs shows a dramatic reduction in capital and operating costs per unit of NdPr oxide of almost 50% and 45% respectively. In large part this is due to the following:

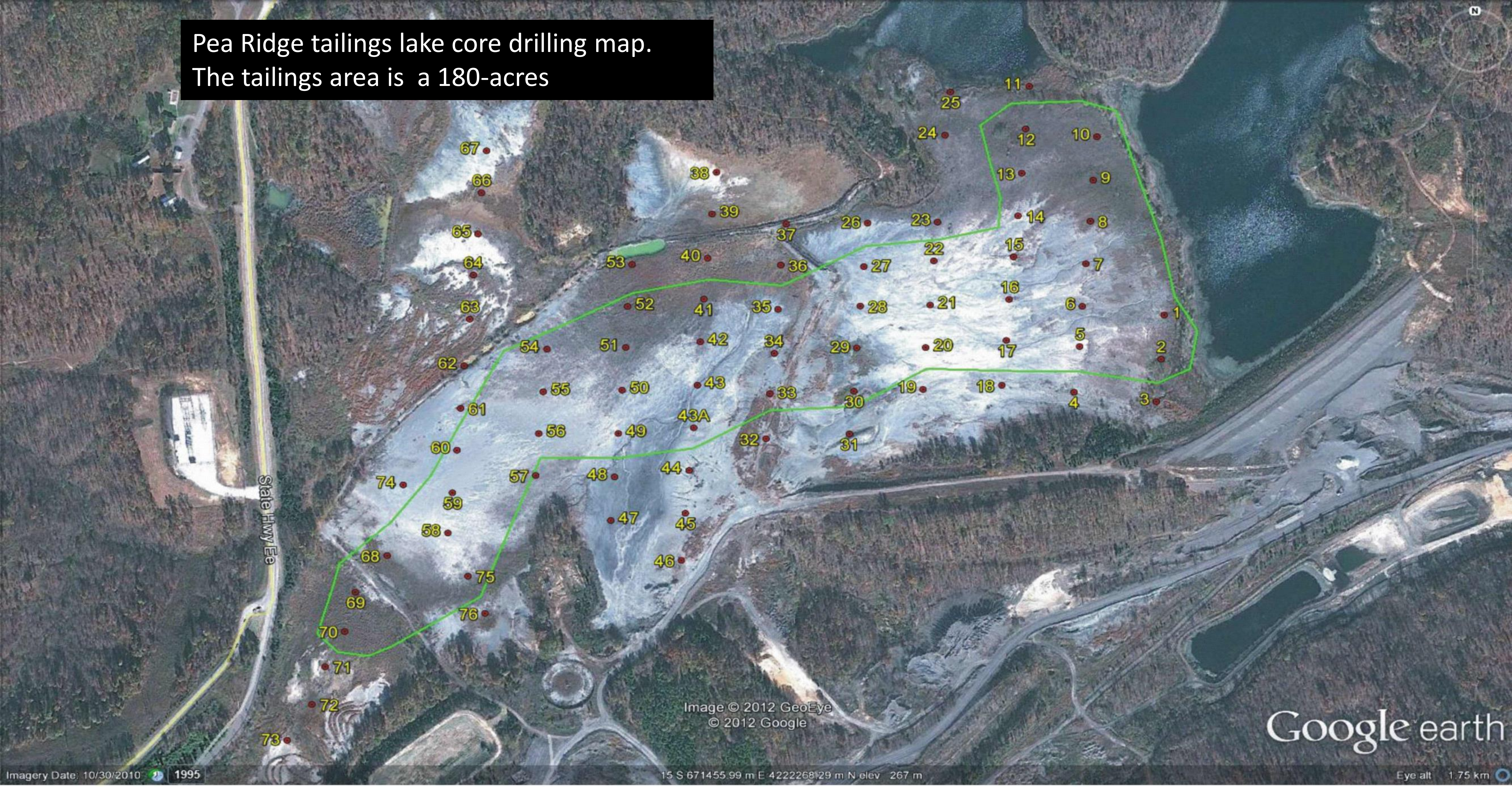
Assay Utilized: Pincock, Allen & Holt Resource Assessment (8.2012)

Total REEs in Raw Tailings ~ 5,000 ppm based on a drilling program that included seventy-four holes, for a total of 4,184 feet of drilling; 1,692 samples were collected.

Oxide	N	Mean ppm	Min ppm	Max ppm	Variance	Q1 ppm	Median ppm	Q3 ppm	CV
Ce_2O_3	1691	1964.4	24	4166	427,162.5	1571	1991	2379	0.33
Eu_2O_3	1691	7.45	1	17	6	6	7	9	0.33
La_2O_3	1691	1,119.1	24	2595	158,883	862	1136	1364	0.36
Nd_2O_3	1692	657	8	1333	51,133	509	668	816	0.34
Pr_2O_3	1691	162.9	2	415	3,659	123	164	204	0.37
Sm_2O_3	1685	99.1	1	816	1,536	76	99	123	0.40
LREO	1692	4,007.6	63	8639	1,803,485	3,186	4,063	4,866	0.34
Dy_2O_3	1692	81.8	1	153	632	68	84	97	0.31
Er_2O_3	1692	56	2	113	309	46	56	67	0.31
Gd_2O_3	1684	98.8	1	193	1,065	79	99	119	0.33
Ho_2O_3	1526	7.58	1	25	23	4	7	11	0.63
Lu_2O_3	1686	11.2	1	29	12	9	11	13	0.31
Tb_2O_3	1641	15.9	1	136	41	13	16	19	0.40
Tm_2O_3	1662	5.6	1	12	3.6	4	6	7	0.34
Yb_2O_3	1692	57.6	1	109	301	48	58	69	0.30
HREO	1692	332.6	5	640	10,486	276	336	397	0.31

TABLE 3-2
Sangra Moller
Pea Ridge Tailings, Resource Estimate
Y_2O_3 and Apatite Stats

Oxide	N	Mean	Min	Max	Var	Q1	Median	Q3	CV
Y_2O_3	1,692	658.3 ppm	13 ppm	1,262 ppm	38,554	545	679 ppm	791	0.30



Priority Area

Pea Ridge Tailings Proposed Drill Program