

Assessing the feasibility of the Inflation Reduction Act's EV critical mineral targets

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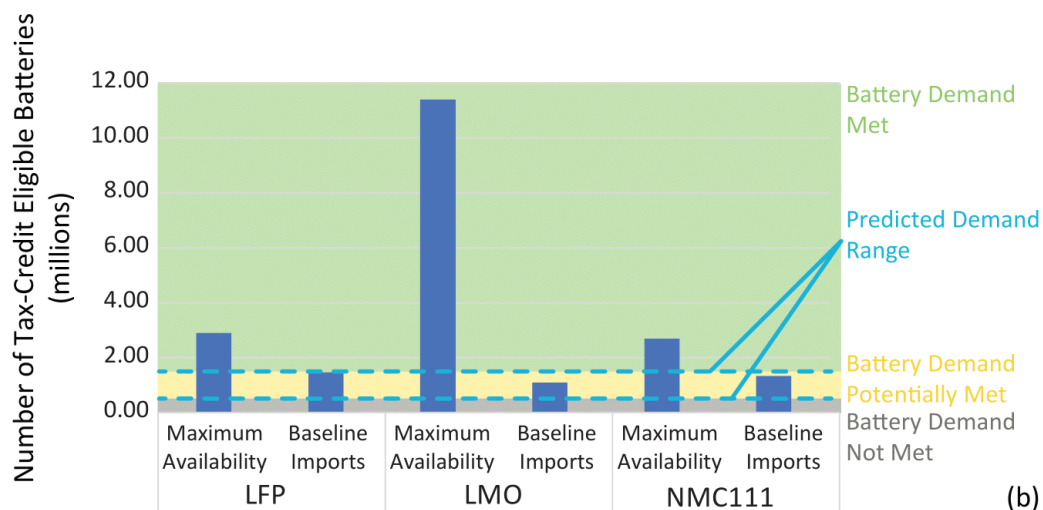
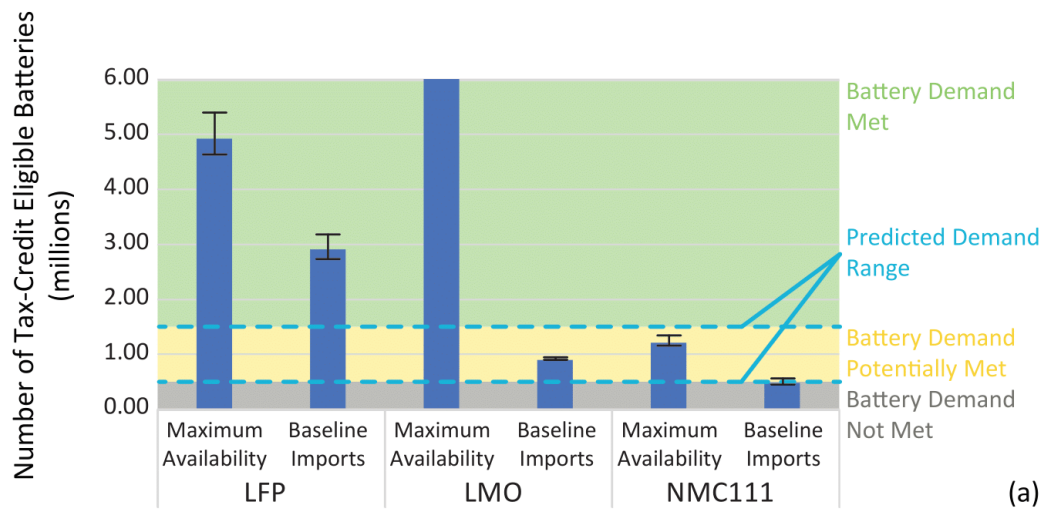


Figure S1. Number of tax-credit eligible PHEV batteries (2027) on a (a) market value and (b) mass basis^{14,16}. At least 80% of the market value of the critical minerals in the number of batteries the blue bars depict derive from the US and FTCs. Maximum availability scenarios assume the U.S. purchases all exported minerals from FTCs. Baseline imports scenarios assume import levels will follow historical patterns. Blue bars that reach into the green-shaded area indicate a supply of batteries that meets demand. Their value is based on calculations using the five-year average market value for critical minerals ($n=5$). Results (blue bars, mean mineral market value $\pm$ SD) are the number of tax-credit eligible batteries available as calculated with the mean mineral market value. Error bars reflect the minimum and maximum number of tax-credit eligible batteries when calculated with mineral market values equal to one standard deviation above and below the mean mineral market value. The center of the error bar corresponds to the result calculated when the mean mineral market values are used.

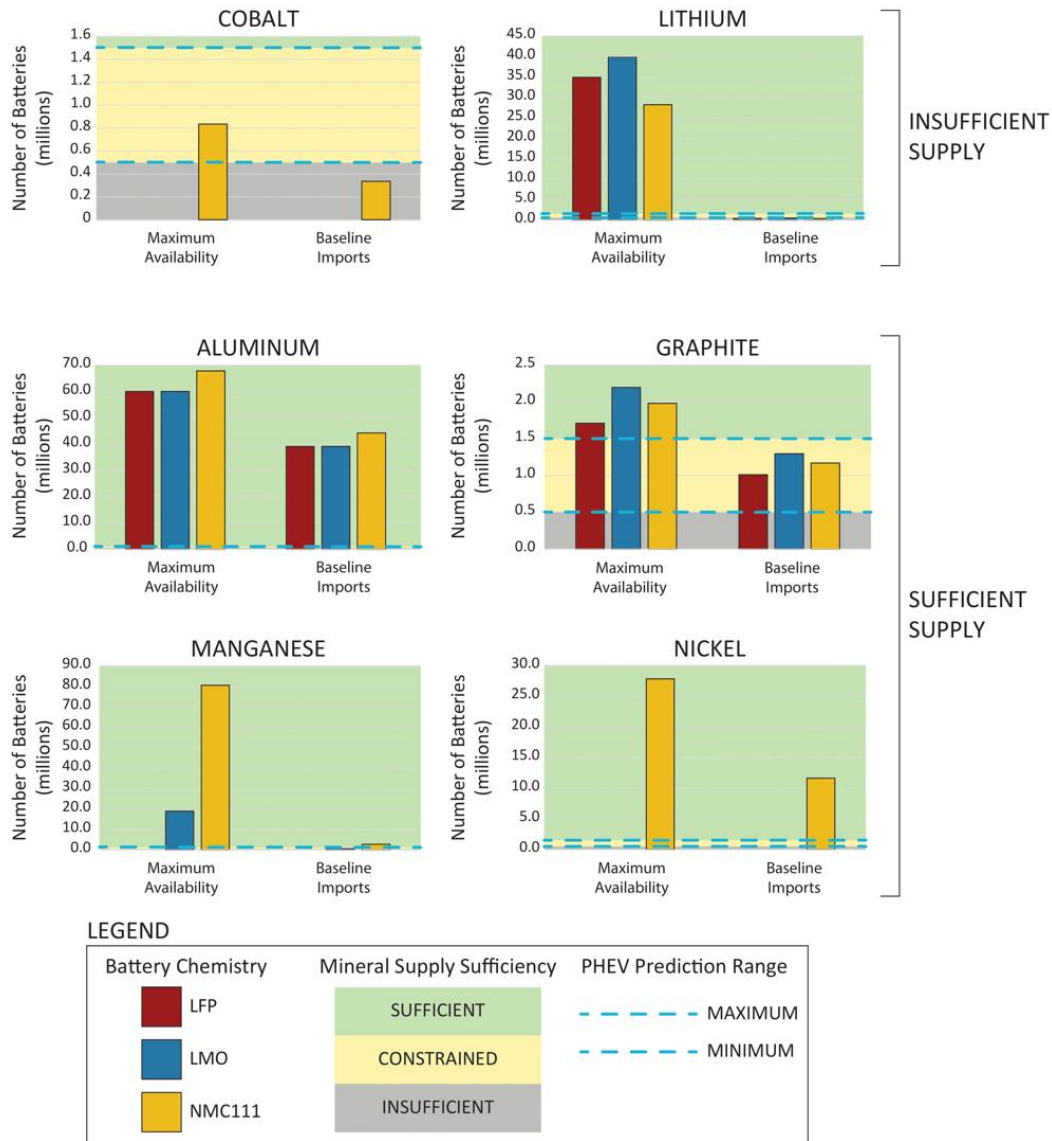
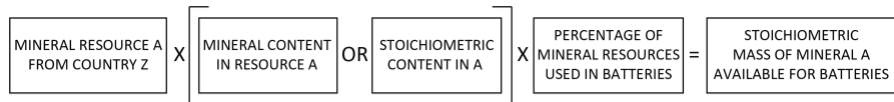
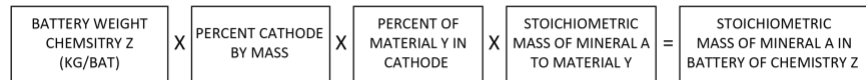


Figure S2. Number of PHEV batteries (2027) by mineral.^{14,16} Blue, yellow, and rust-colored bars represent batteries with NMC, NCA, and LFP chemistries, respectively. Bars falling in grey-, yellow- and green-shaded areas indicate insufficient, constrained, and sufficient mineral supply, respectively. The IEA estimates a range in battery demand which introduces uncertainty into mineral requirements; this is reflected by the height of the yellow-shaded area.

CALCULATION FLOW - PRODUCTION AND IMPORTS

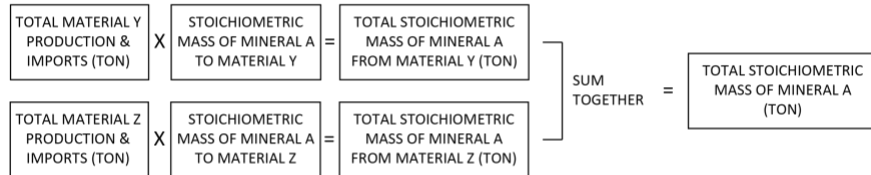


CALCULATION FLOW - STOICHIOMETRIC MINERAL MASS IN BATTERIES

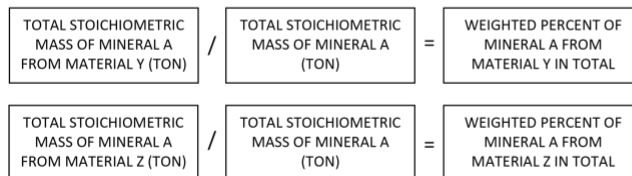


CALCULATION FLOW - WEIGHTED AVERAGE STOICHIOMETRIC MINERAL MARKET VALUE

TOTAL STOICHIOMETRIC AMOUNT OF MINERAL A



WEIGHTED PERCENT OF MINERAL A IN GIVEN MATERIAL



WEIGHTED AVERAGE MARKET VALUE OF MINERAL A

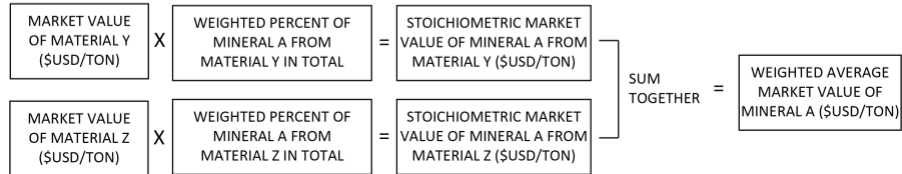


Figure S3. Stoichiometric Mass and Market Value Calculation Flow

Sample Calculations:

Production and Imports

Total Production of Lithium Carbonate from Chile

$$99300 \text{ tons Li}_2\text{CO}_3 * (1 \text{ mol Li}_2\text{CO}_3 / 73.89 \text{ g Li}_2\text{CO}_3) * (2 \text{ mol Li} / 1 \text{ mol Li}_2\text{CO}_3) * (6.94 \text{ g Li} / 1 \text{ mol Li}) = 18668 \text{ tons Li}$$

Total Production of Ferromanganese Production from Australia

$$83,000 \text{ tons ferromanganese} * (.78 \text{ g manganese content} / 1 \text{ g ferromanganese}) \\ = 64,740 \text{ tons Mn}$$

Stoichiometric Mineral Mass in Batteries

NCA BEV Battery – Nickel Content

$$(739.1 \text{ lb battery}) * (1 \text{ kg} / 2.2 \text{ lbs}) * (0.346 \text{ kg cathode} / 1 \text{ kg battery}) * (0.95 \text{ kg mineral mixture} / 1 \text{ kg cathode}) * (1.36 \text{ kg NiSO}_4 / 1 \text{ kg mineral mixture}) * (1 \text{ mol NiSO}_4 / 0.155 \text{ kg NiSO}_4) * (1 \text{ mol Ni} / 1 \text{ mol NiSO}_4) * (0.0587 \text{ kg Ni} / 1 \text{ mol Ni}) = 59.96 \text{ kg Ni} / \text{battery}$$

LFP PHEV Battery – Aluminum Content

$$(263.0 \text{ lb battery}) * (1 \text{ kg} / 2.2 \text{ lbs}) * (0.195 \text{ kg Al} / 1 \text{ kg battery}) = 23.31 \text{ kg Al} / \text{battery}$$

Weighted Average Stoichiometric Market Value

Graphite: Natural (Amorphous and Crystalline Flake)

Stoichiometric calculation of amorphous and crystalline flake masses:

Amorphous

$$11200 \text{ tons amorphous graphite} * (0.75 \text{ kg graphite} / 1 \text{ kg amorphous graphite}) = 8400 \text{ tons graphite}$$

Crystalline Flake

$$11200 \text{ tons crystalline flake graphite} * (0.86 \text{ kg graphite} / 1 \text{ kg crystalline flake graphite}) = 3406 \text{ tons graphite}$$

Total Graphite Mass:

$$8400 \text{ tons} + 3406 \text{ tons} = 11806 \text{ tons graphite}$$

Weighted percent of amorphous graphite content and crystalline flake graphite content in total graphite mass:

Amorphous

8400 tons amorphous graphite content / 11806 tons graphite content = 71.2%

Crystalline Flake

3406 tons crystalline flake graphite content / 11806 tons graphite content = 28.8%

Weighted average market value of natural graphite (for 2017):

$(431 \text{ \$USD/ton amorphous graphite}) * (0.712) + (1390 \text{ \$USD/ton crystalline flake}) = 721.88$
\$USD/ton graphite content