

# Metals/Minerals 202 % US Import Dependence, Key Uses

## 100% Import Dependent

## 96 - >50% Import Dependent

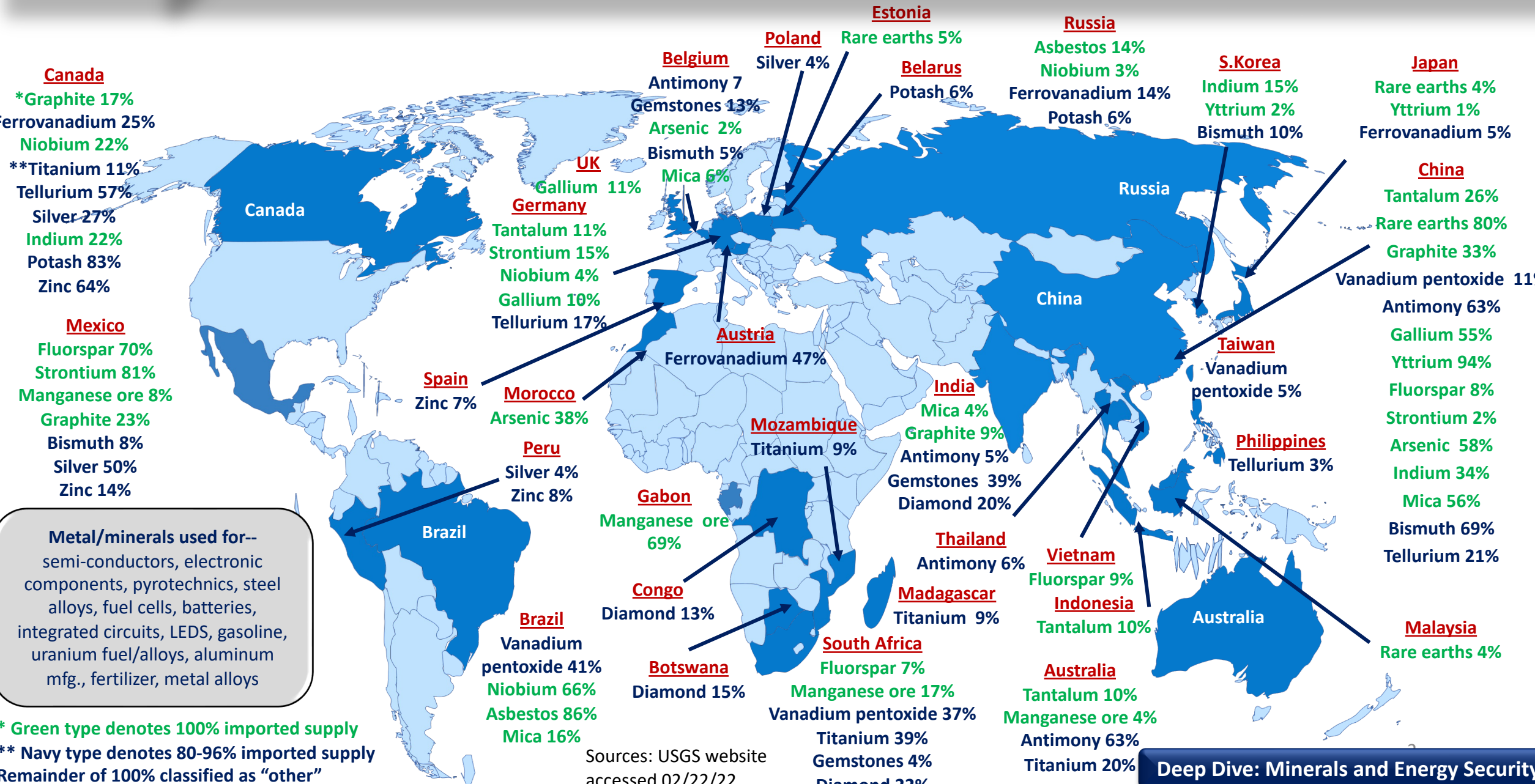
<b>Arsenic</b>	Lumber preservatives, pesticides, lead acid batteries, <b>solar cells</b>
<b>Tantalum</b>	Electronic components, <b>gas turbine alloys</b>
<b>Strontium</b>	Pyrotechnics, ceramic magnets, <b>drilling fluids</b>
<b>Scandium</b>	Alloys, <b>fuel cells, electronics</b>
<b>Rubidium</b>	<b>Electronics</b> , glass
<b>Rare Earths</b>	Catalysts, ceramics, glass, alloys, metallurgy
<b>Niobium</b>	<b>Steel alloys</b>
<b>Manganese</b>	<b>Steel production</b>
<b>Indium</b>	LCD screens, <b>electrical components</b>
<b>Graphite</b>	Lubricants, <b>batteries, fuel cells</b>
<b>Gallium</b>	steel making Integrated circuits, optical devices (LEDs)
<b>Fluorspar</b>	<b>Aluminum manufacturing, gasoline, uranium fuel</b> , refrigerants
<b>Cesium</b>	Oil/gas well drilling, fuel cells
<b>Yttrium</b>	Catalysts, ceramics, metallurgy, <b>jet engines</b>
<b>Asbestos</b>	Oil industry, rubber sheet, vehicle friction products
<b>Mica (sheet)</b>	<b>Oil drilling</b> , roofing, rubber products

<b>Vanadium</b>	96% Metal, steel, uranium alloys
<b>Tellurium</b>	>95% Cooling, <b>energy production, solar cells</b> , cast iron production
<b>Bismuth</b>	94% Used in medical/ atomic research
<b>Potash</b>	90% Fertilizer, chemical, & industrial apps
<b>Titanium*</b>	>88% White pigment, metal alloys
<b>Diamond</b>	84% Computer chips, <b>O&amp;G drilling, transportation</b>
<b>Zinc</b>	83% Metal galvanizing
<b>Antimony</b>	81% Flame retardants, metal products, ceramics, glass
<b>Silver</b>	80% <b>Electricity, electricity conductivity, batteries, plastics</b>
<b>Platinum</b>	79% Catalytic agents
<b>Rhenium</b>	76% <b>Lead-free gasoline</b> , super alloys
<b>Cobalt</b>	76% <b>Rechargeable batteries</b> , superalloys
<b>Barite</b>	>75% <b>Oil/gas drilling</b>
<b>Bauxite</b>	>75% <b>Cement, petroleum industries</b>
<b>Iron Oxide</b>	>75% <b>Concrete, construction materials</b>
<b>Tin</b>	75% Coatings & alloys for steel
<b>Chromium</b>	75% <b>Stainless steel</b> , other alloys
<b>Gold</b>	>52% <b>Electrical/electronics</b>
<b>Tungsten</b>	>50% Wear-resistant metals
<b>Germanium</b>	>50% Fiber optics, <b>solar cells</b>
<b>Lithium</b>	>50% <b>Batteries, EVs</b>
<b>Nickel</b>	>50% Steel alloys

Sources: USGS; Methodological Note to the Inventory of Export Restrictions on Industrial Raw Materials  
\*Titanium mineral concentrates

Note: Navy type indicates on USGS Critical List 2022  
Red type highlights some key energy uses

# US Metals, Minerals on Which the US 80 to 100% Import Dependent, Country Suppliers of US Market/% Total Imports from Country



Metal/minerals used for--  
 semi-conductors, electronic components, pyrotechnics, steel alloys, fuel cells, batteries, integrated circuits, LEDs, gasoline, uranium fuel/alloys, aluminum mfg., fertilizer, metal alloys

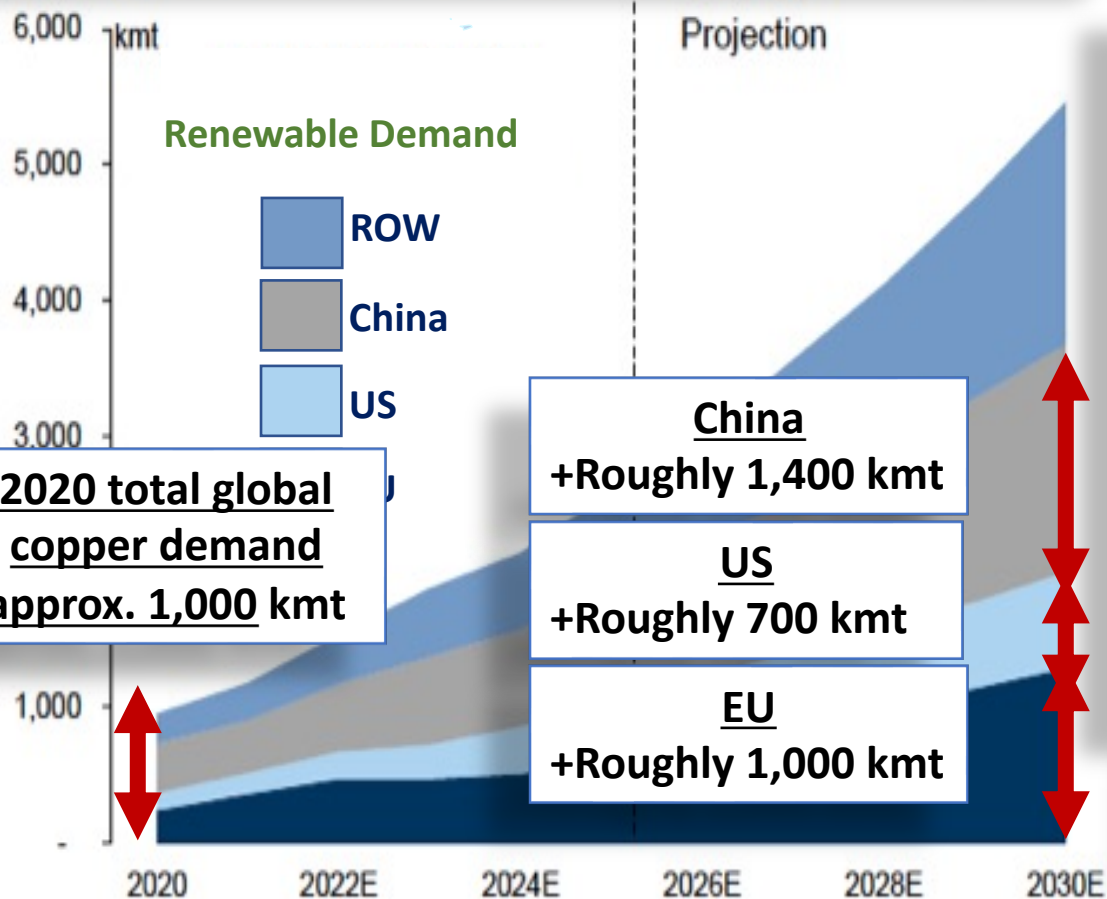
\* Green type denotes 100% imported supply  
 \*\* Navy type denotes 80-96% imported supply  
 Remainder of 100% classified as "other"

Sources: USGS website accessed 02/22/22



# Demand for Electrification/Transportation = \$10,000 per ton Copper

## Green electrification related copper demand by region



## Copper, 5 Year Price Chart



140 M EVs by 2030 in IEA's SDS X 183 lbs. of copper/EV = 11.6 million Mt of copper for EVs

Global production, 2020: approx. 20 million Mt

US uses (%): building construction, 43%; electrical and electronic products, 21%; transportation equipment, 19%; consumer and general products, 10%; and industrial machinery and equipment, 7%.



# Reference Frame: High Voltage Transmission Line Materials Needed by 2050

EIA: In 2016, there were 160,000 miles of high voltage transmissions lines



Princeton NZA (E+RE pathway with base land availability): The US will need a 75% increase in transmission capacity by 2030 to meet net zero targets



Assume 60% of that capacity is achieved by adding new miles (the other 40% is met with technology improvements)



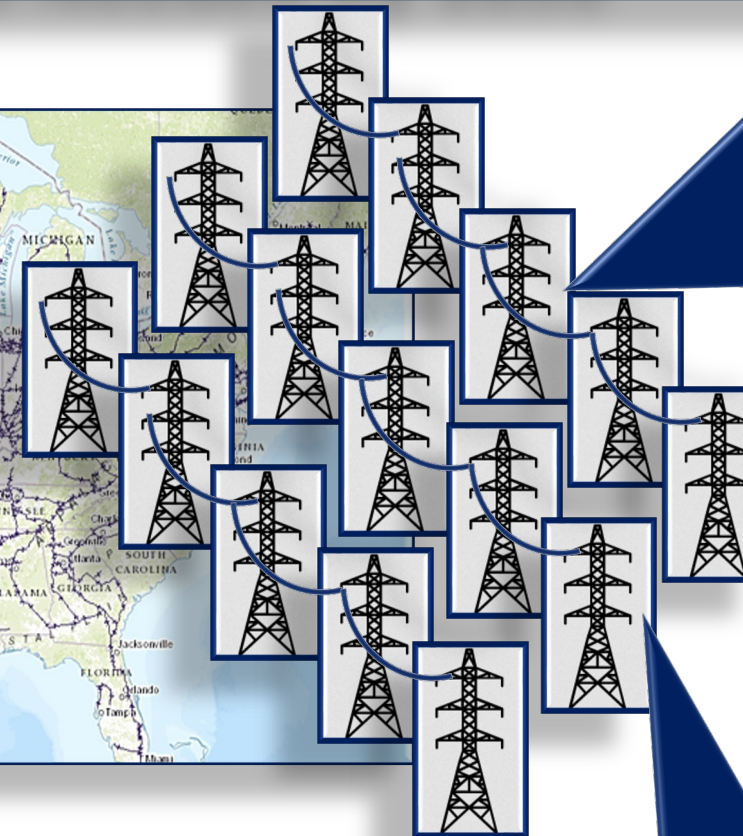
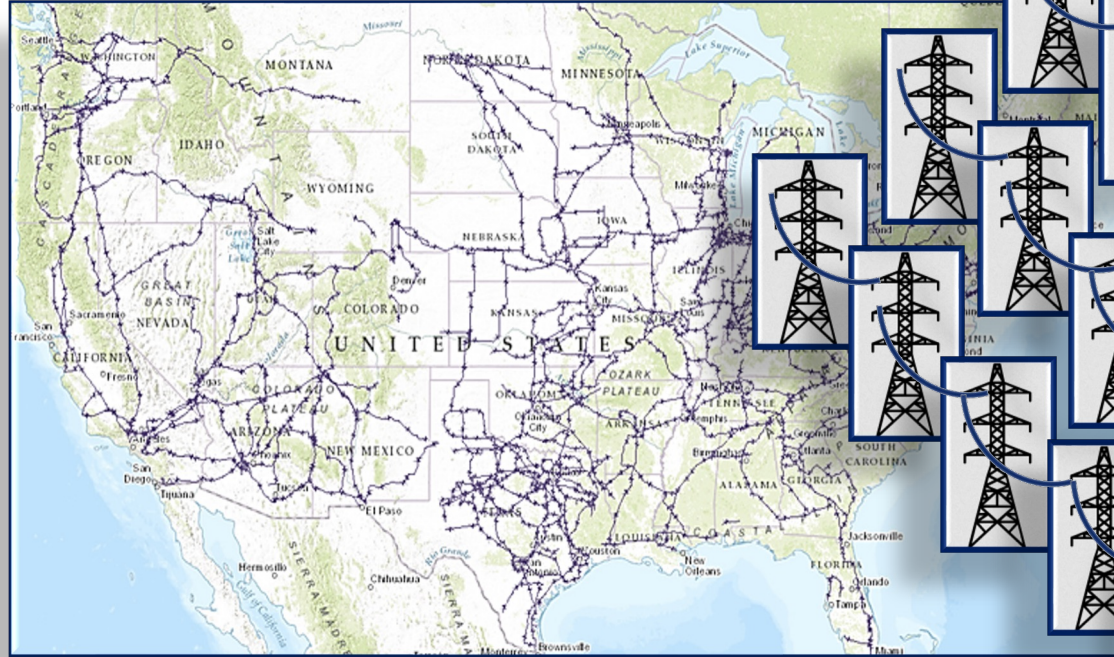
60% of 96,000 translates to 72,000 miles of new high voltage transmission lines by 2030



There are between 5 and 5.6 towers per mile on a high voltage transmission line (credible numbers range from 5 to 5.6)



At 5 towers/mile, we will need 360,000 transmission towers by 2030



Transmission towers are made of steel, aluminum and copper, among other materials. So are transmission lines. So are wind turbines. So are cell towers. So are EVs. So are EV charging stations