Energy Transition Delusion & The Physics of Money

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The elephant in the room: Mineral demands rise >1,000%



Increases in minerals per energy machine

Increases in global mining to meet demand

Global energy: 20 years and \$5 trillion



Carbon impact of U.S. GND & \$1 trillion



IEA: 100s of new mines needed & \$100s billions

"Will the looming [copper] supply gap short-circuit the energy transition?" S&P Global







Global spending to expand metals supply

Near-term cost impact of chasing minerals



Long-term impact reverses a century of declining metal prices

IEA transition policies would cause metal prices to "reach historical peaks . . .for an unprecedented, sustained period of roughly a decade." IMF



Cost of raw materials per EV @ 10% of global sales



Cost of green machines rising

Material inputs ~70% cost solar module, battery



Future metals costs & iron law of declining ore grades

Mining today: 40% global industrial energy



At today's costs wind-solar grid parity is a myth



The German example: 2x grid and 2x electricity rates

Germany: 6% primary <u>energy</u> from wind+solar



The European experiment: rising wind/solar \rightarrow rising rates

More wind + solar \rightarrow higher grid costs



The U.S. experiment: rising wind/solar \rightarrow rates up 300%

Xcel's 4 million customers in Midwest



An all solar-wind-battery America \rightarrow 5x grid + \$15 trillion storage

