The Renewable Energy Transition: Truths and Consequences

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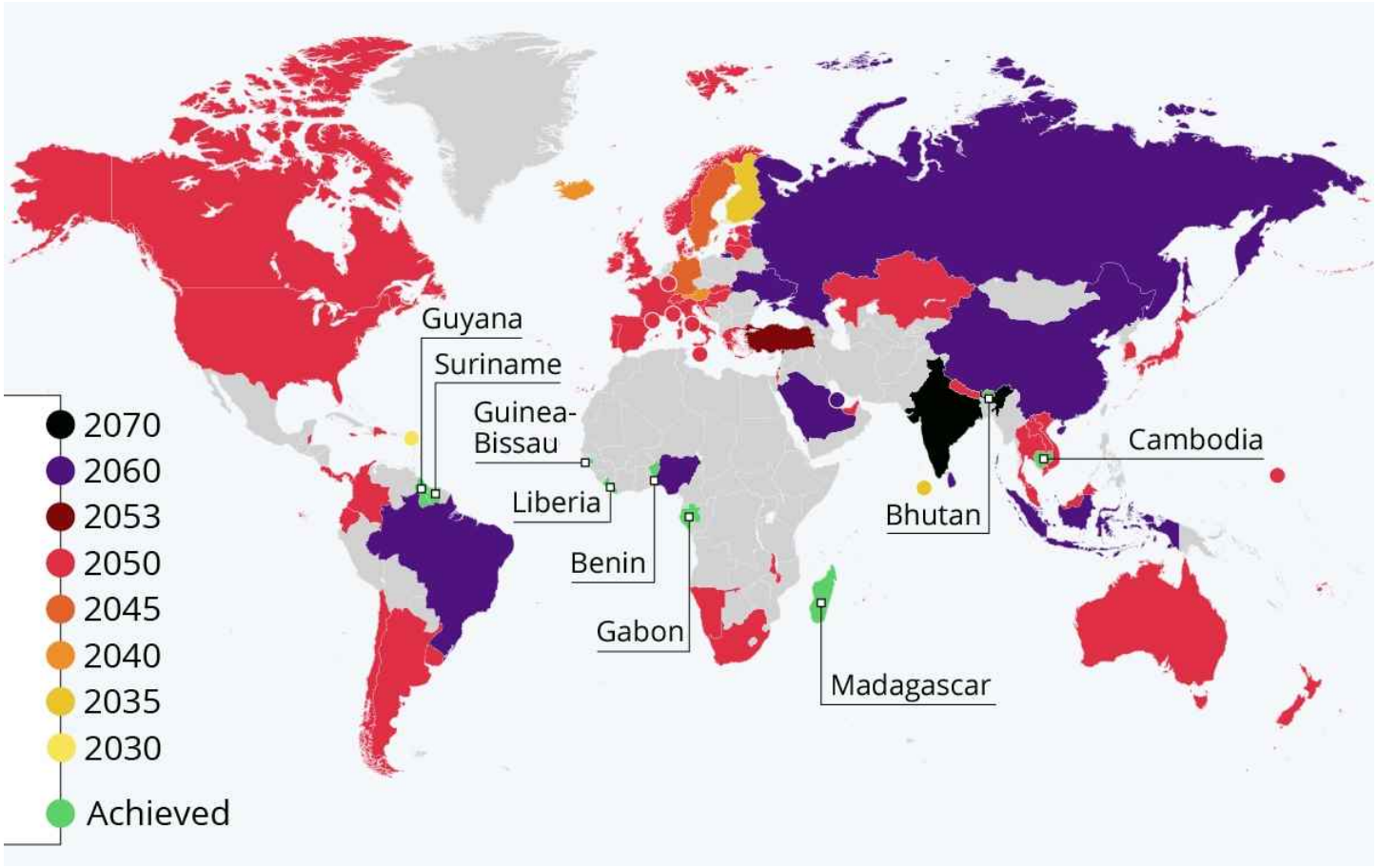
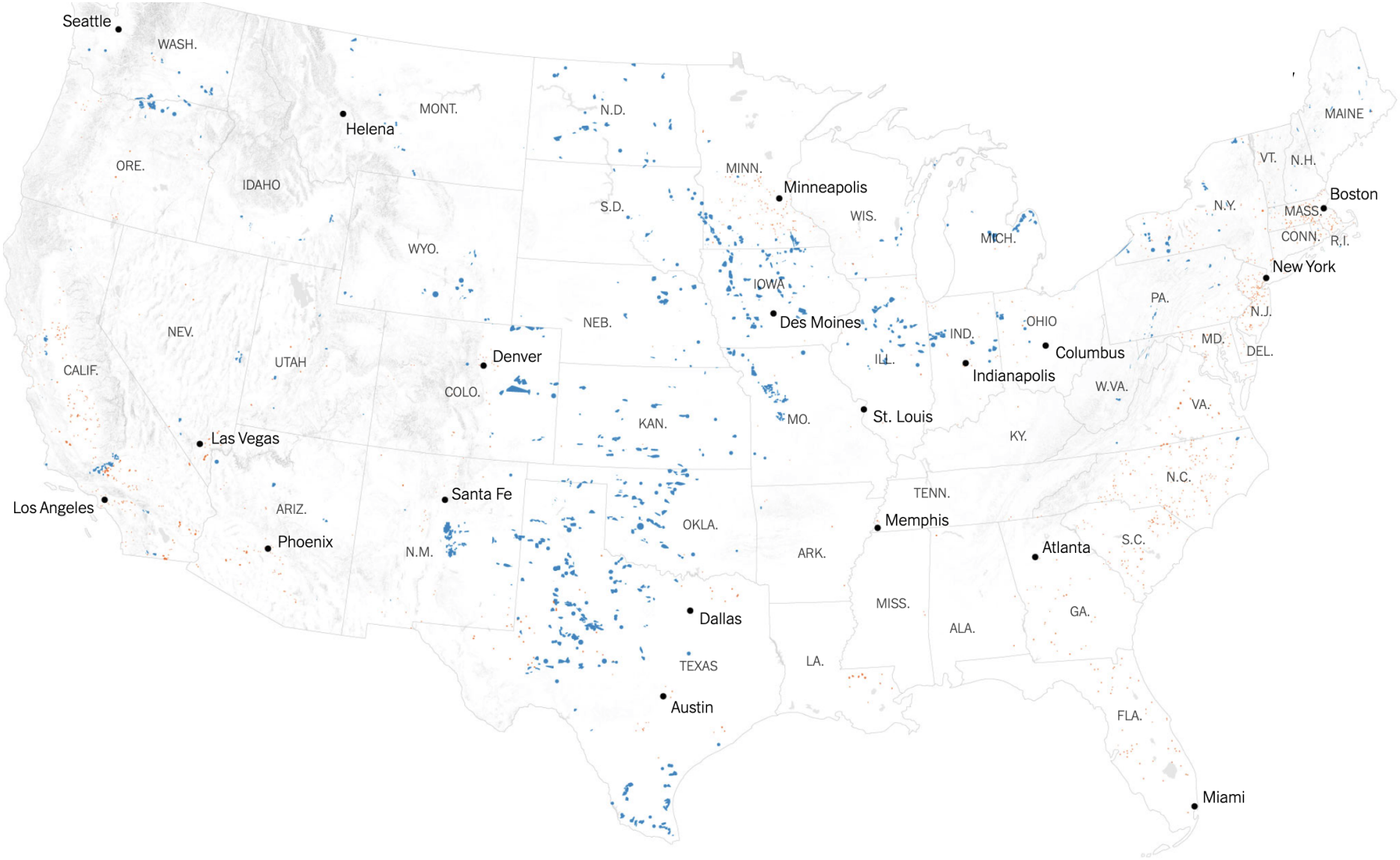
Pledges for Net Zero Emissions

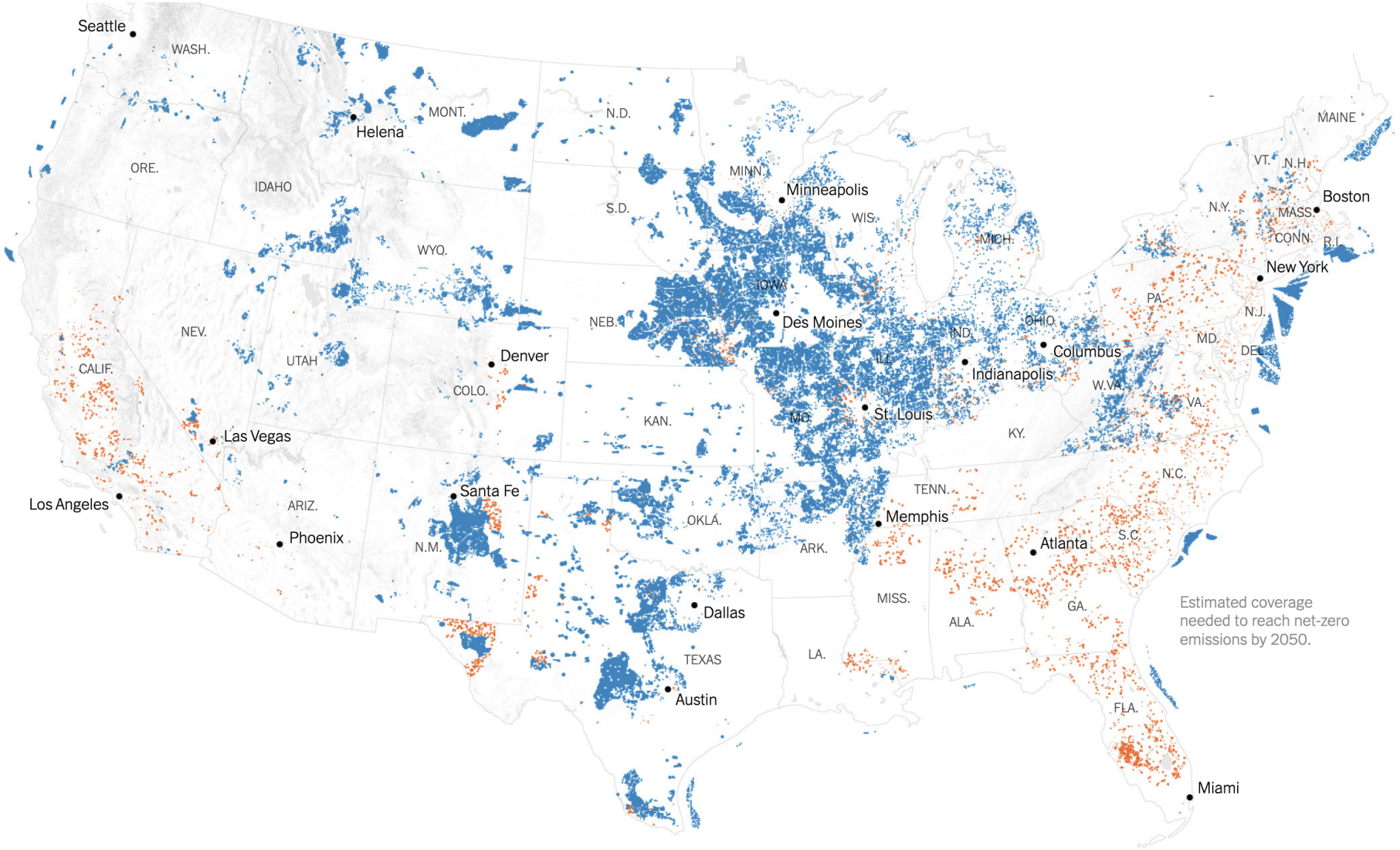


One pathway to achieving net zero emissions globally by 2050 requires a combination of photovoltaic solar + wind turbines produce about 90% of energy consumption.

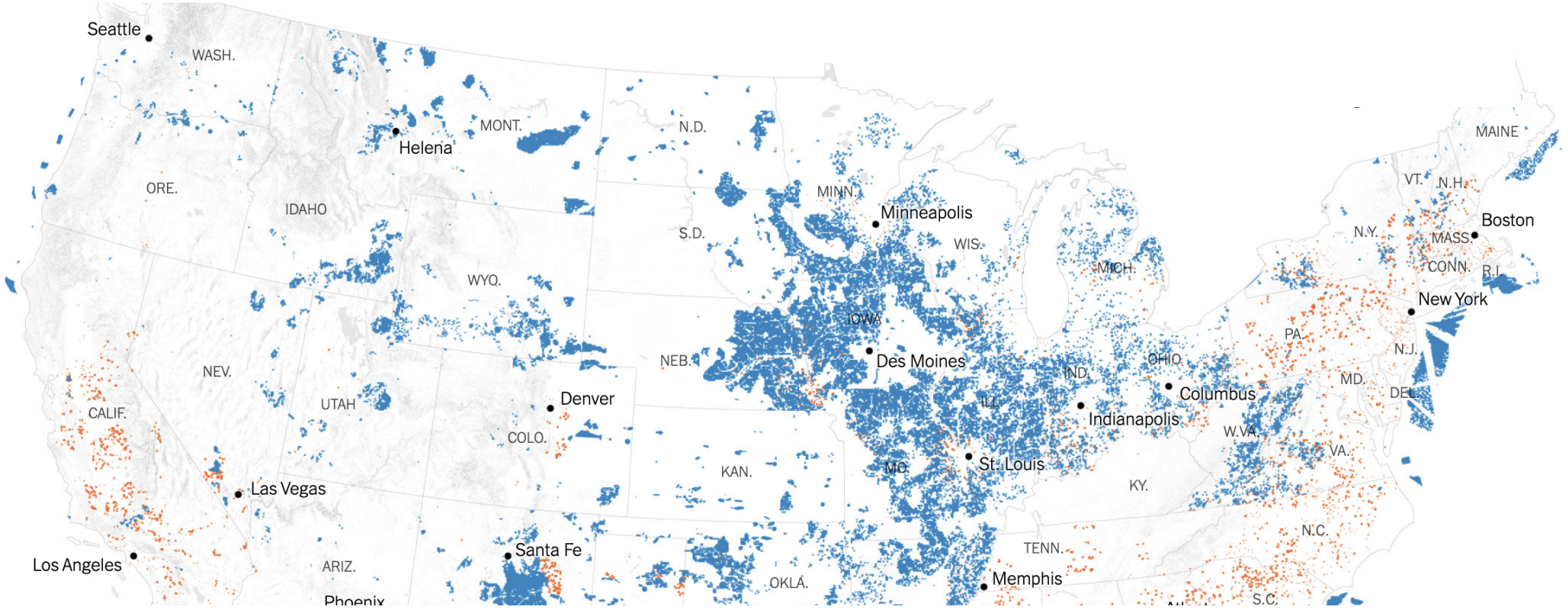
Wind and Solar now



Wind and Solar needed by 2050



Wind and Solar needed by 2050



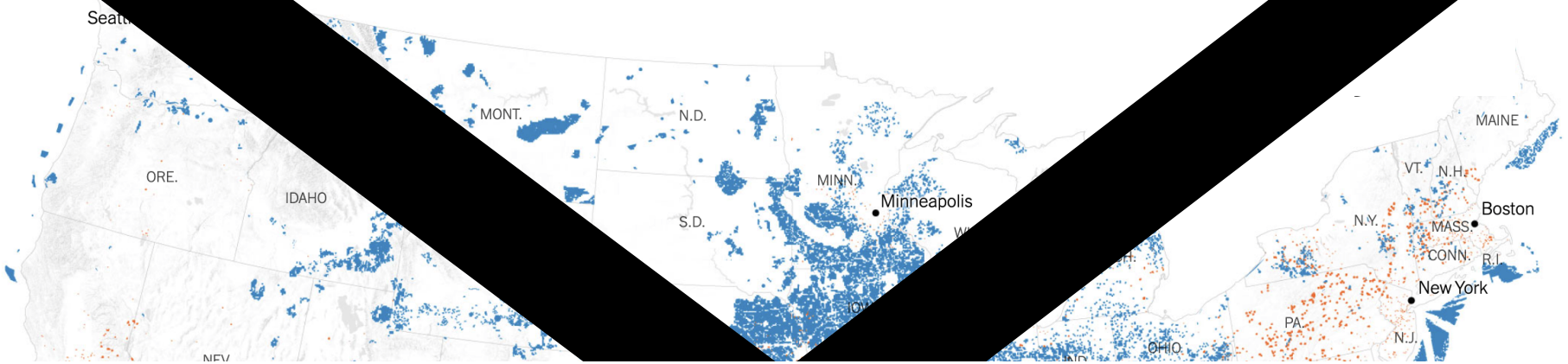
Net zero requires 3 TW capacity solar + 3 TW capacity wind

30 million acres of land for solar

1 million 3 MW wind turbines

16 million EVs annually in the U.S.

nd and Solar needed by 2



This will not happen.

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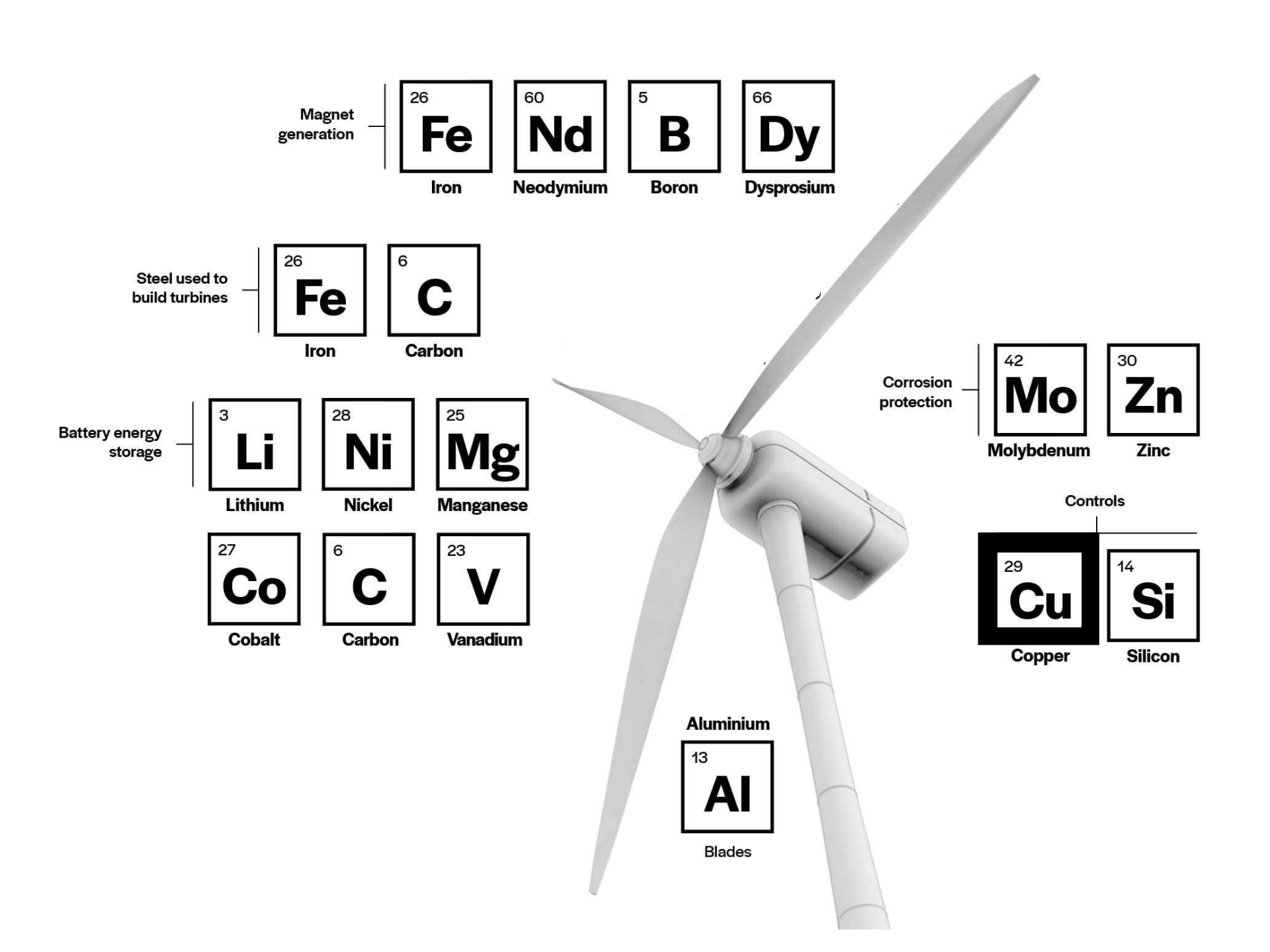

Magnet generation
26 Fe Iron
60 Nd Neodymium
5 B Boron
66 Dy Dysprosium
Steel used to build turbines
26 Fe Iron
6 C Carbon
Battery energy storage
3 Li Lithium
28 Ni Nickel
25 Mg Manganese
27 Co Cobalt
6 C Carbon
23 V Vanadium
Corrosion protection
42 Mo Molybdenum
30 Zn Zinc
Controls
29 Cu Copper
14 Si Silicon
Aluminium
13 Al
Blades

Solar panels

48	52	42	4	32	31
Cd	Te	Mo	Be	Ge	Ga
Cadmium	Tellurium	Molybdenum	Beryllium	Germanium	Gallium

49	47	14
In	Ag	Si
Indium	Silver	Silicon

Semi-conductor

5	15
B	P
Boron	Phosphorous

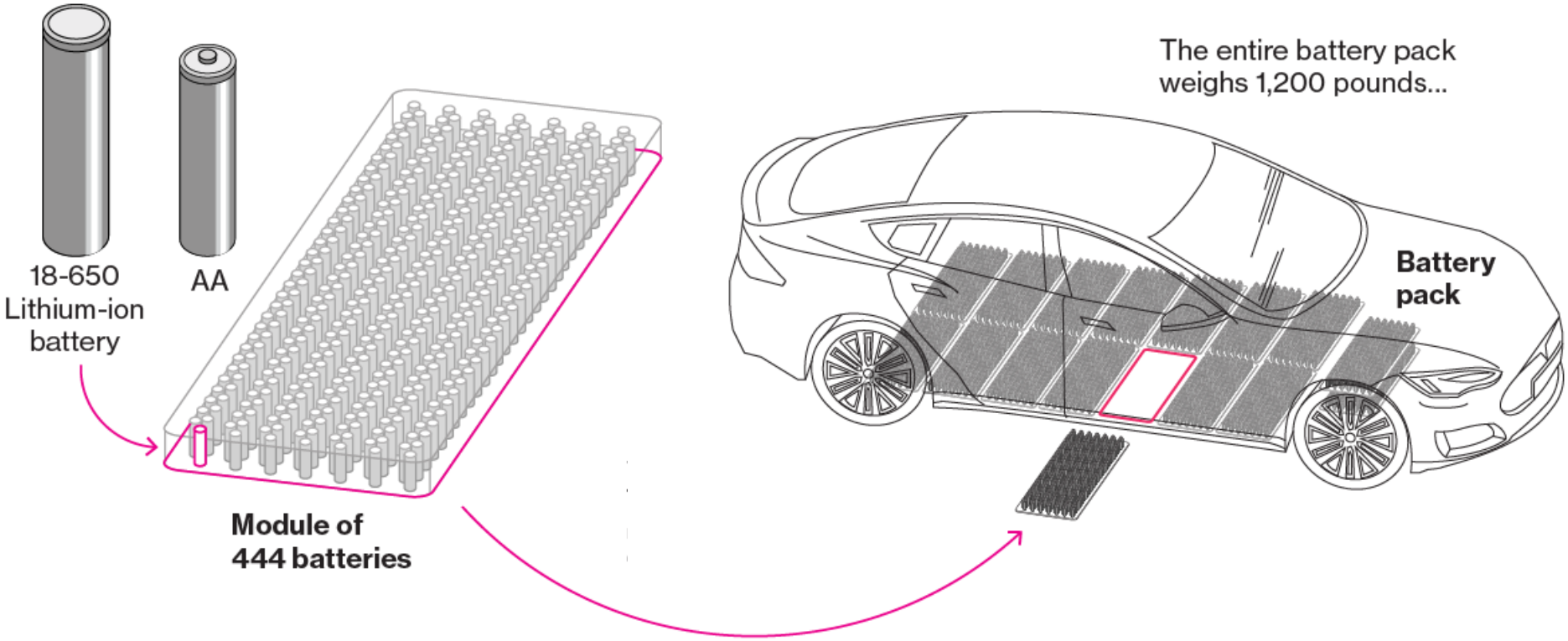
Copper

29
Cu
Wiring

Frame

13	22
Al	Ti
Aluminium	Titanium

30	12
Zn	Mg
Zinc	Magnesium

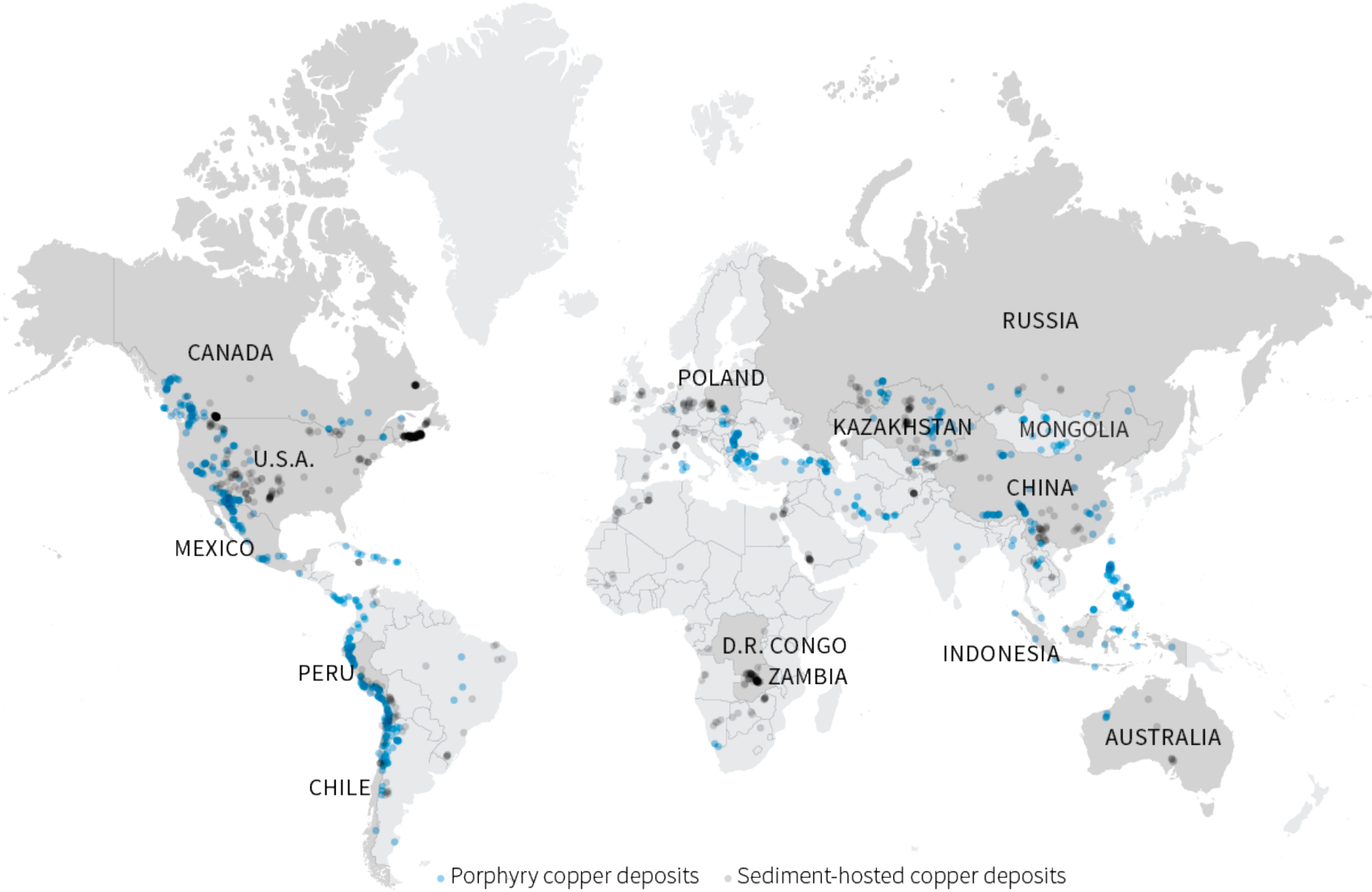


A typical battery electric vehicle contains

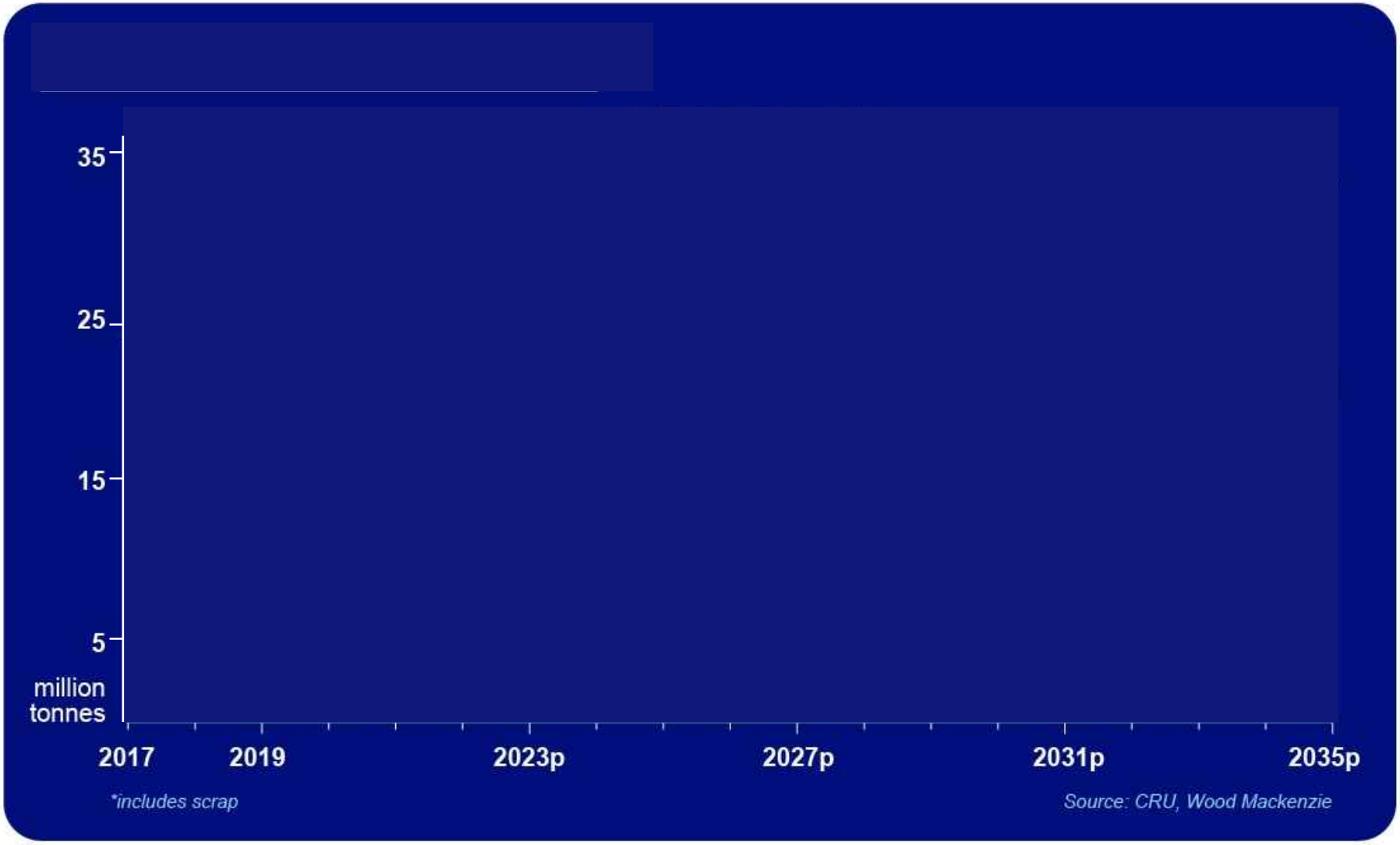
Lithium	25 pounds
Copper	200 pounds
Nickel	60 pounds
Manganese	44 pounds
Cobalt	31 pounds
Rare Earth Metals	5-11 pounds


COPPER
29
Cu
63.55
1085 °C
8.92 g/cm³

250 copper mines in 40 countries



Global Copper Demand vs. Supply to 2035



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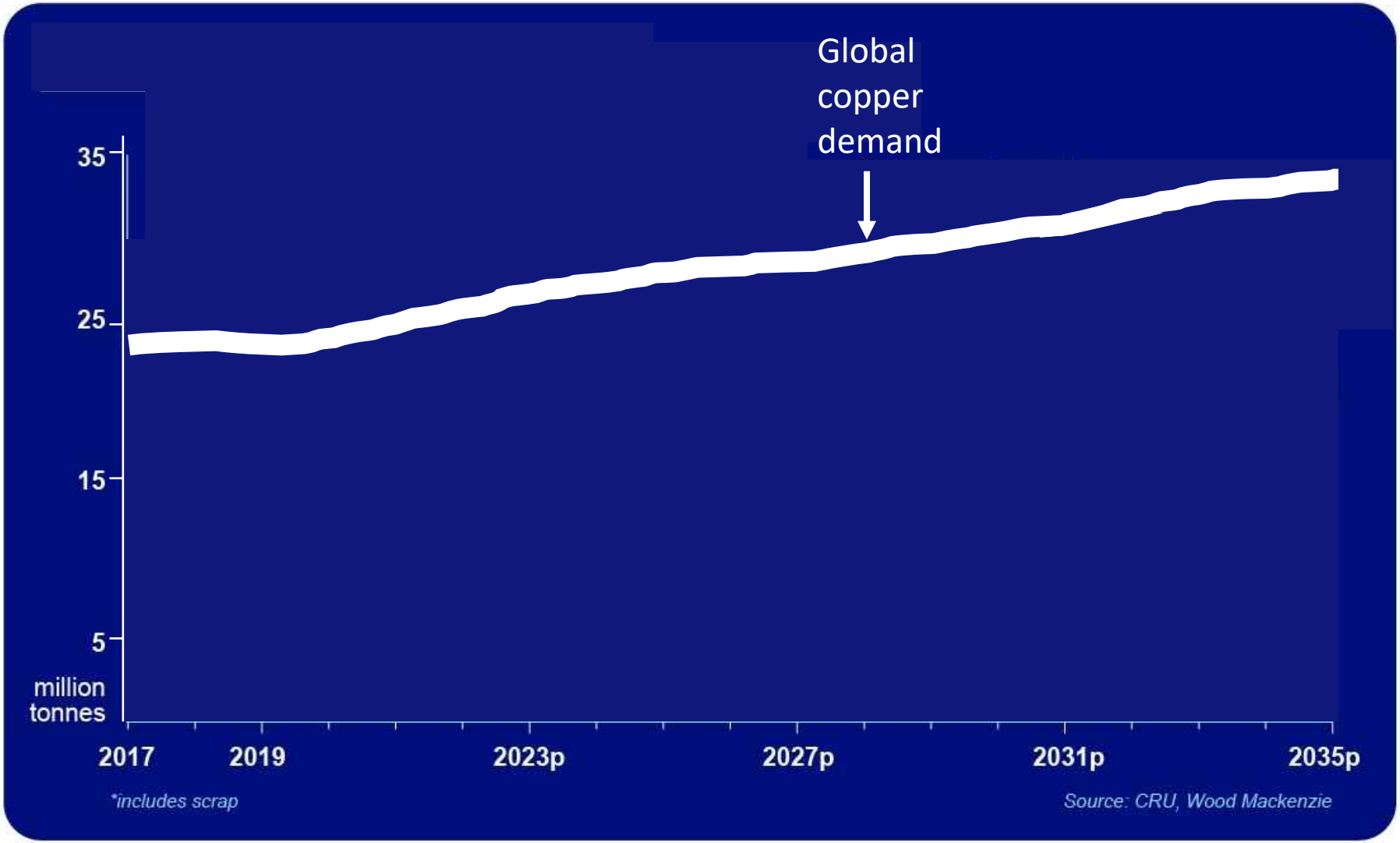

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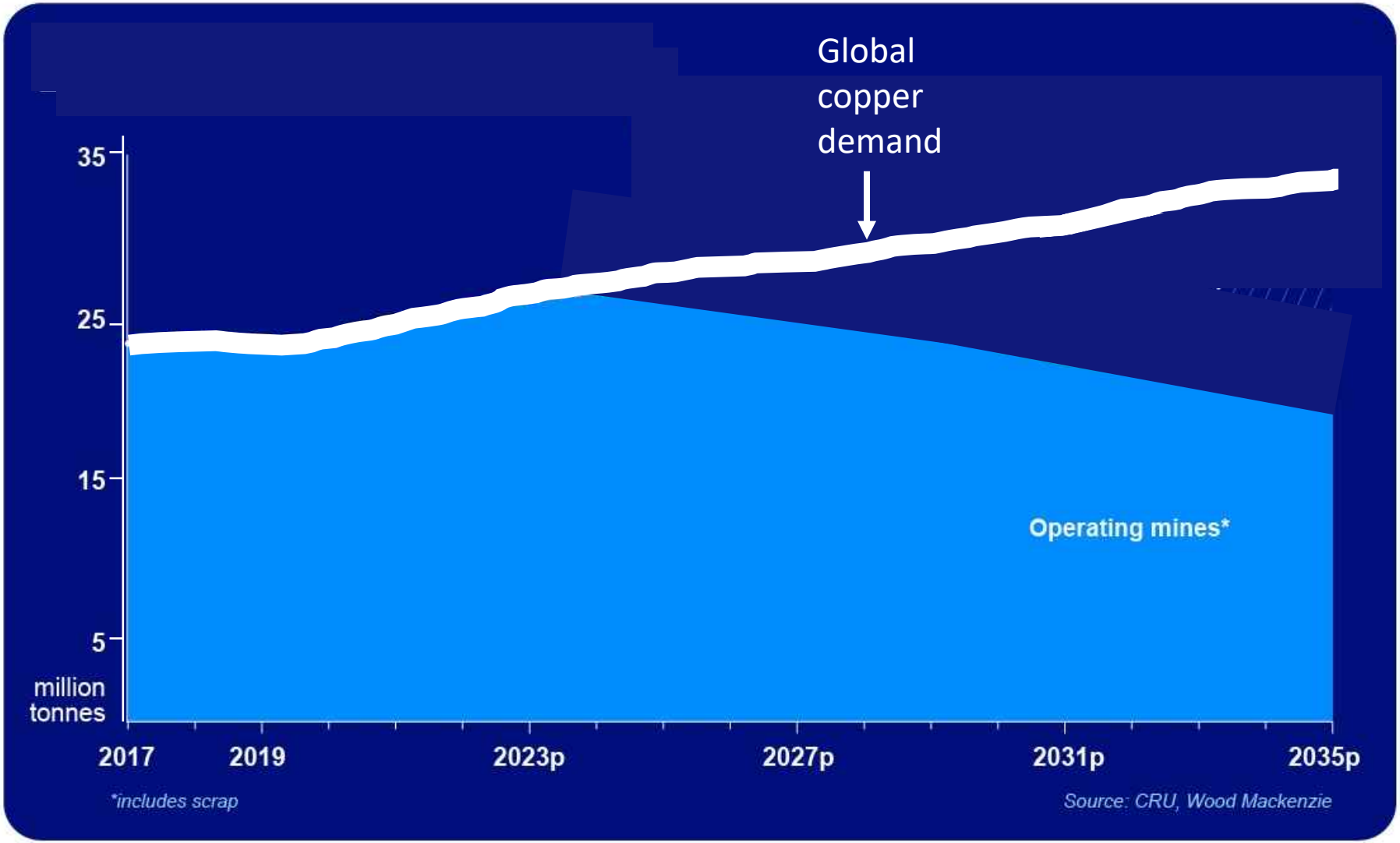

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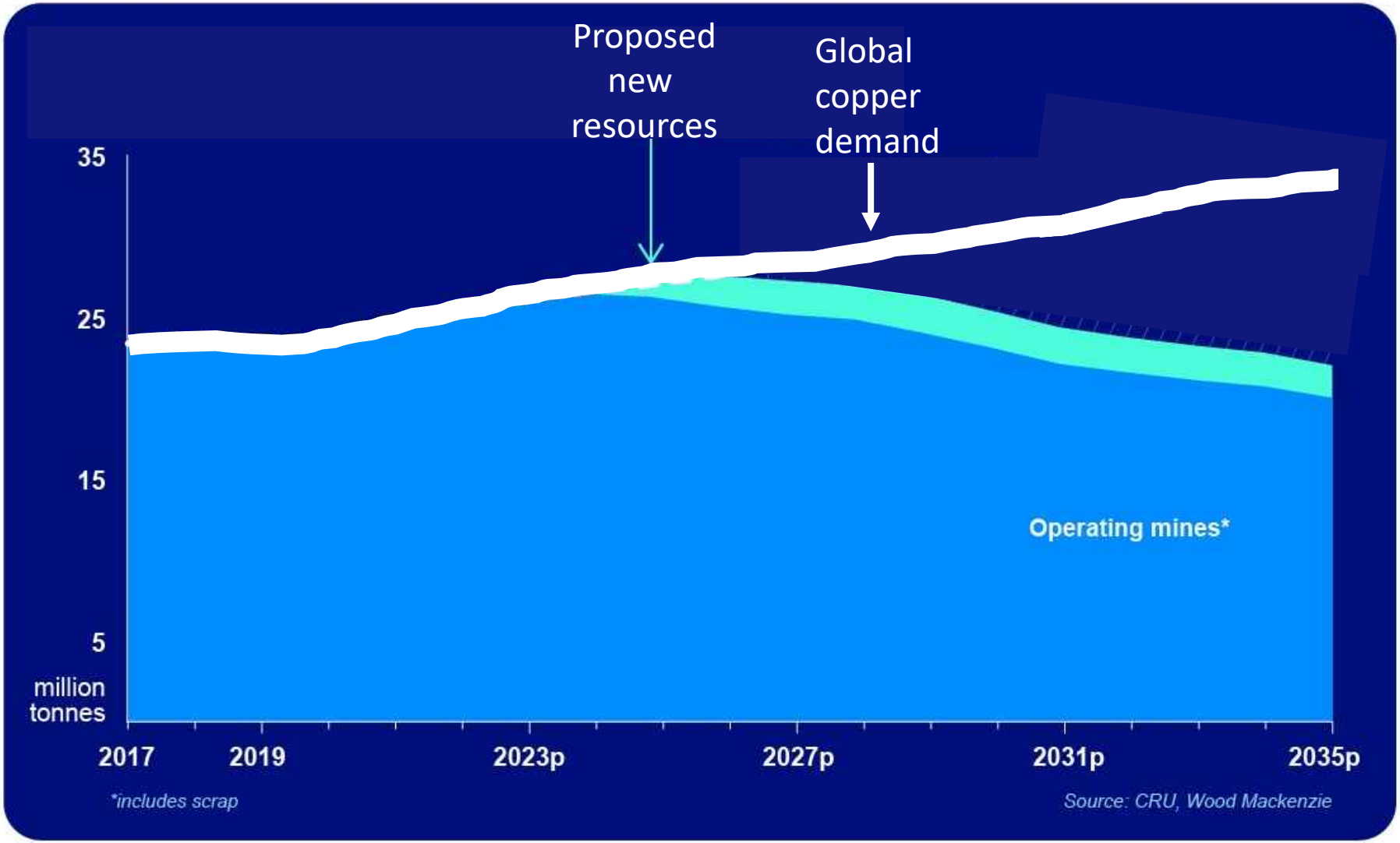
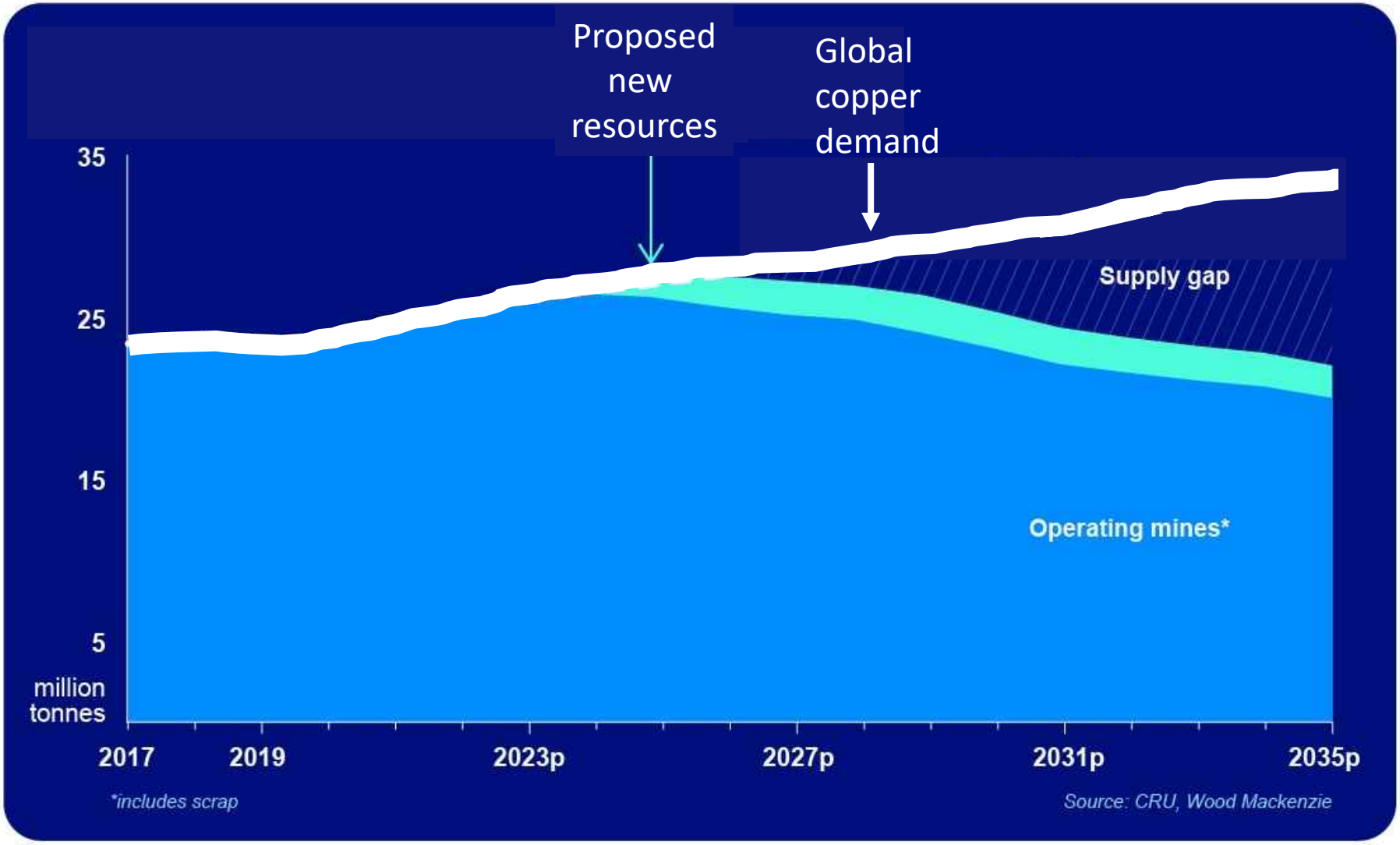


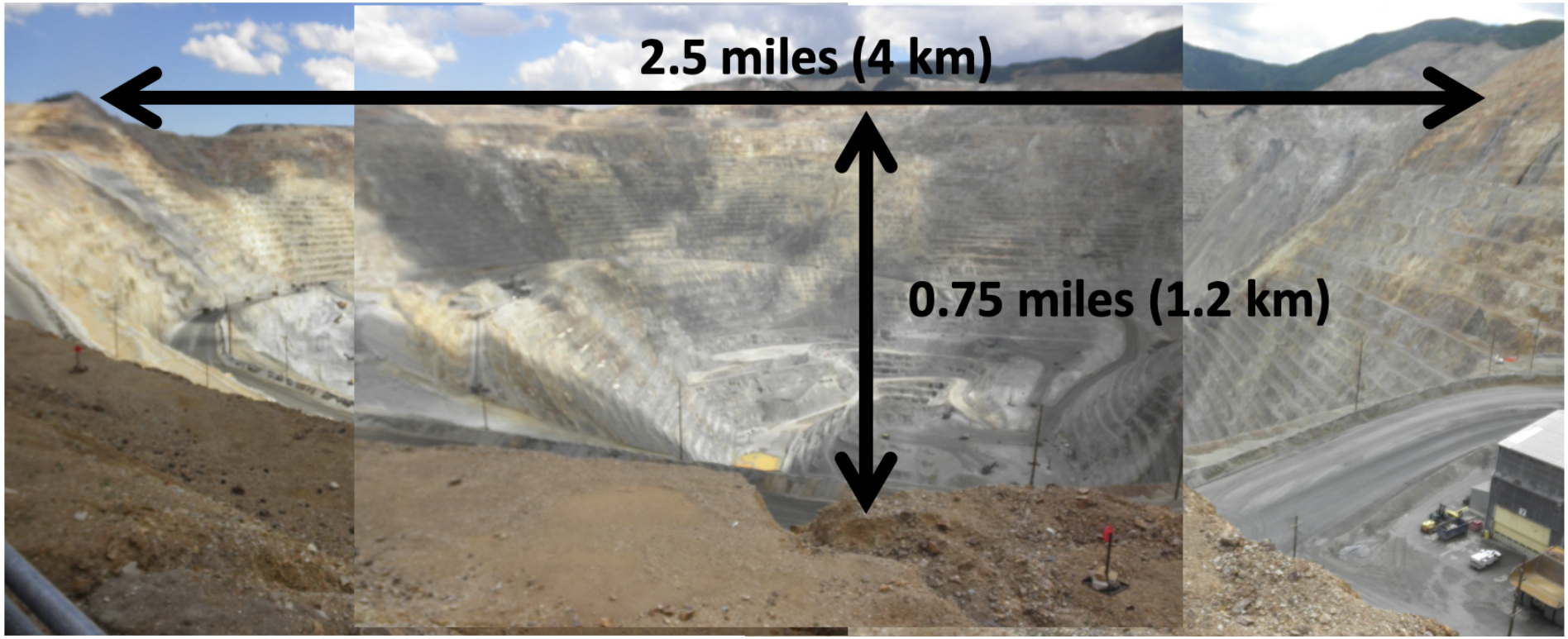
Global Copper Demand vs. Supply, 2017-2035

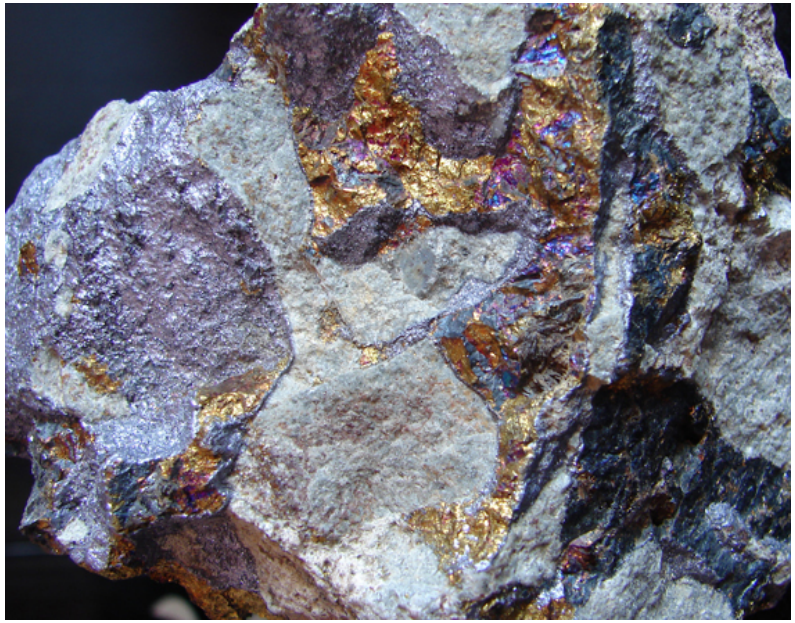


There is a deficit of at least 10 million tonnes of copper per year by 2030.

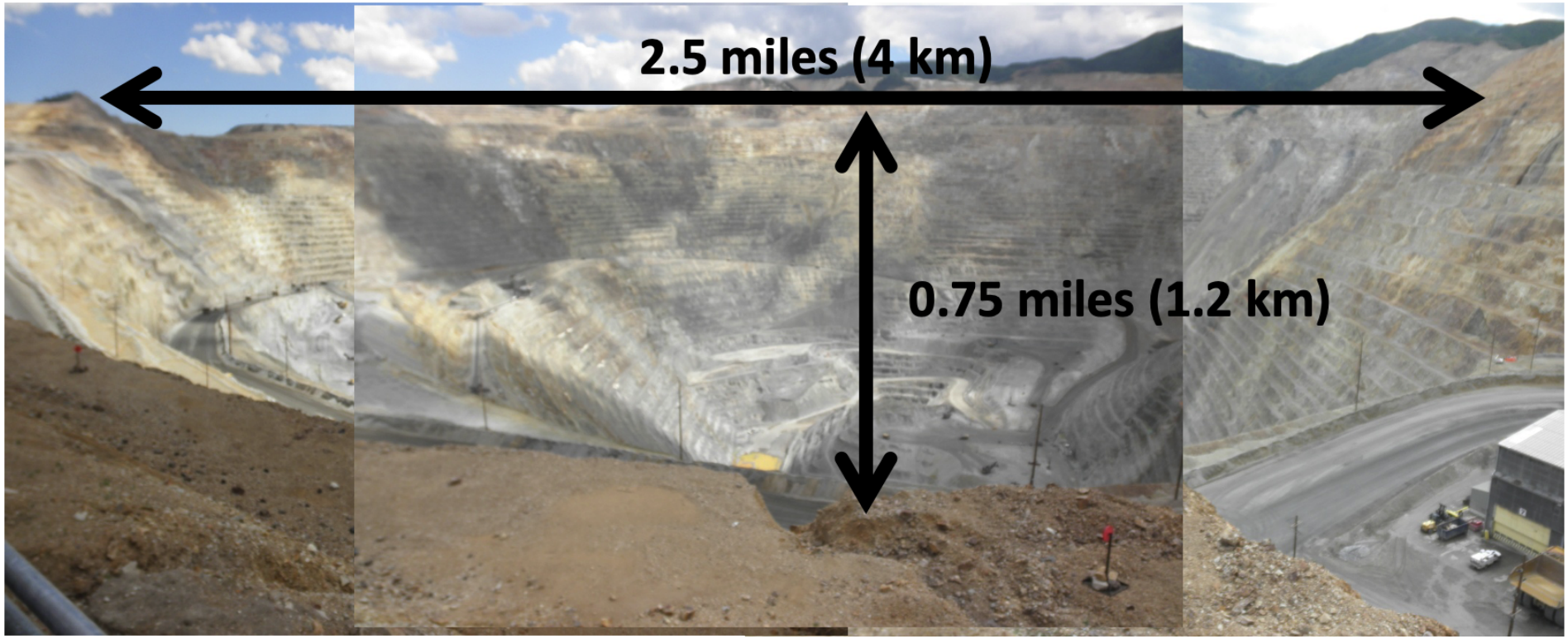
Carbon neutrality requires new mining. <u>Lots.</u>

SALT LAKE CITY AREA
STATE OF UTAH
LOCATION MAP





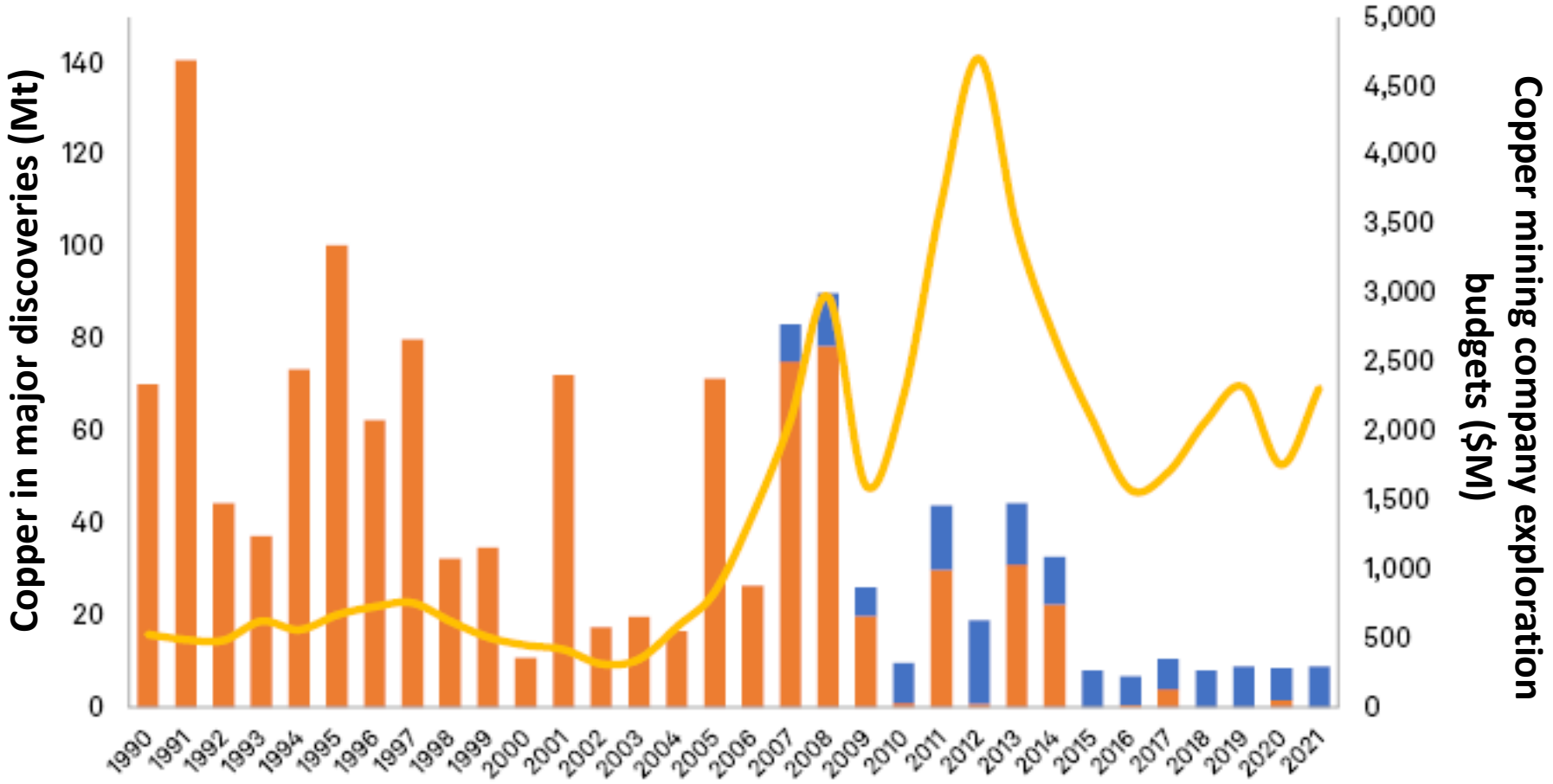
This mine produces ~150,000 tonnes of copper per year.



65 mines this size need to be discovered, permitted, and fully operational by 2030 to achieve net zero by photovoltaic solar + wind turbines.

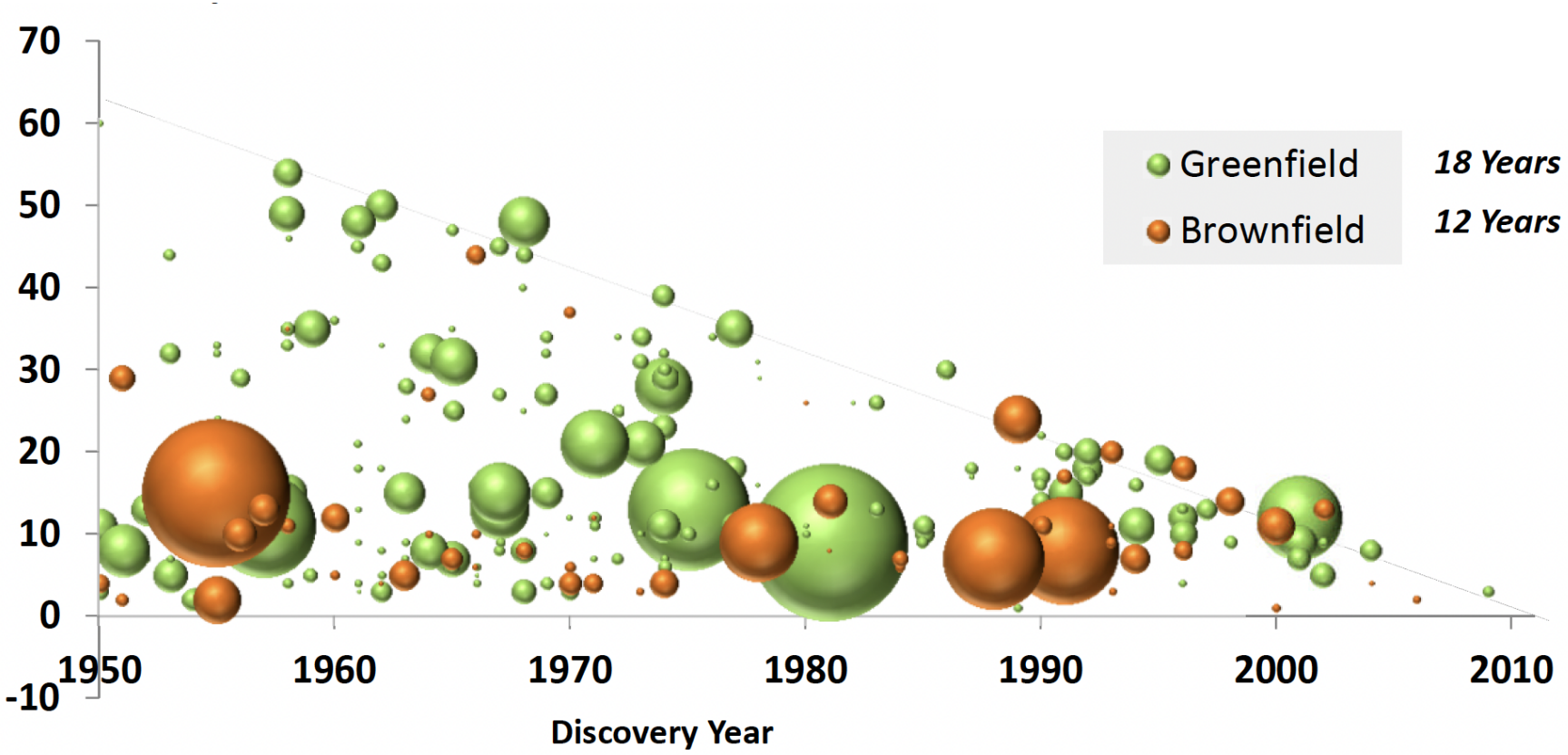
This is not possible.

Global copper ore deposit discoveries



Data as of 10 May 2022

Years from Discovery to Production




PROTECT OUR
AIR - WATER
QUALITY OF LIFE
NO MINE


PROTECT OUR
AIR - WATER
QUALITY OF LIFE
NO MINE
NO
MINE
SAVE
OUR
WATER


NO
MINE
DO NO
OPEN T
MINE


NO
MINING
Mining Has Its Place
—That Place Is Australia
Farmers
It's OUR FUTURE
NO MINING

The New York Times

Biden Administration Cancels Mining Leases Near Wilderness Area

The leases, reinstated during the Trump years, would have allowed a Chilean mining conglomerate to dig for copper and nickel near the Boundary Waters wilderness in Minnesota.

Jan. 26, 2022

Proposed annual metal production

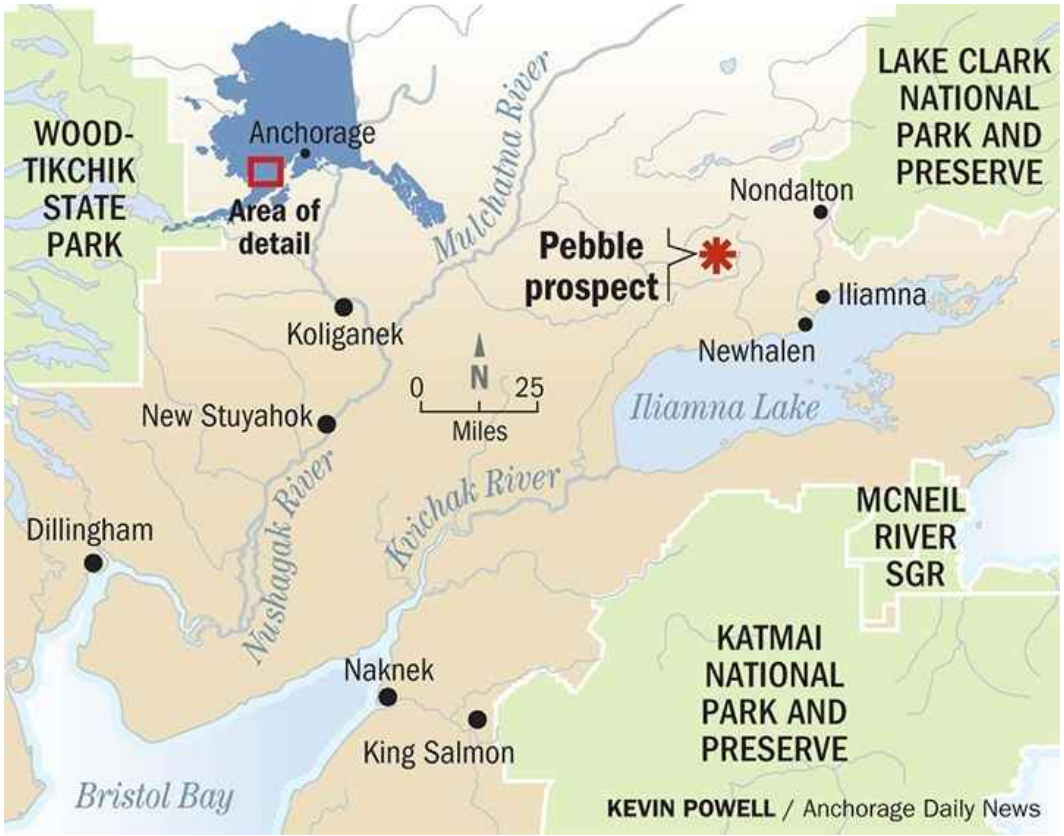
99 million pounds copper

31 million pounds nickel

1.6 million pounds cobalt

Energy & Environment — Biden administration blocks Pebble Mine

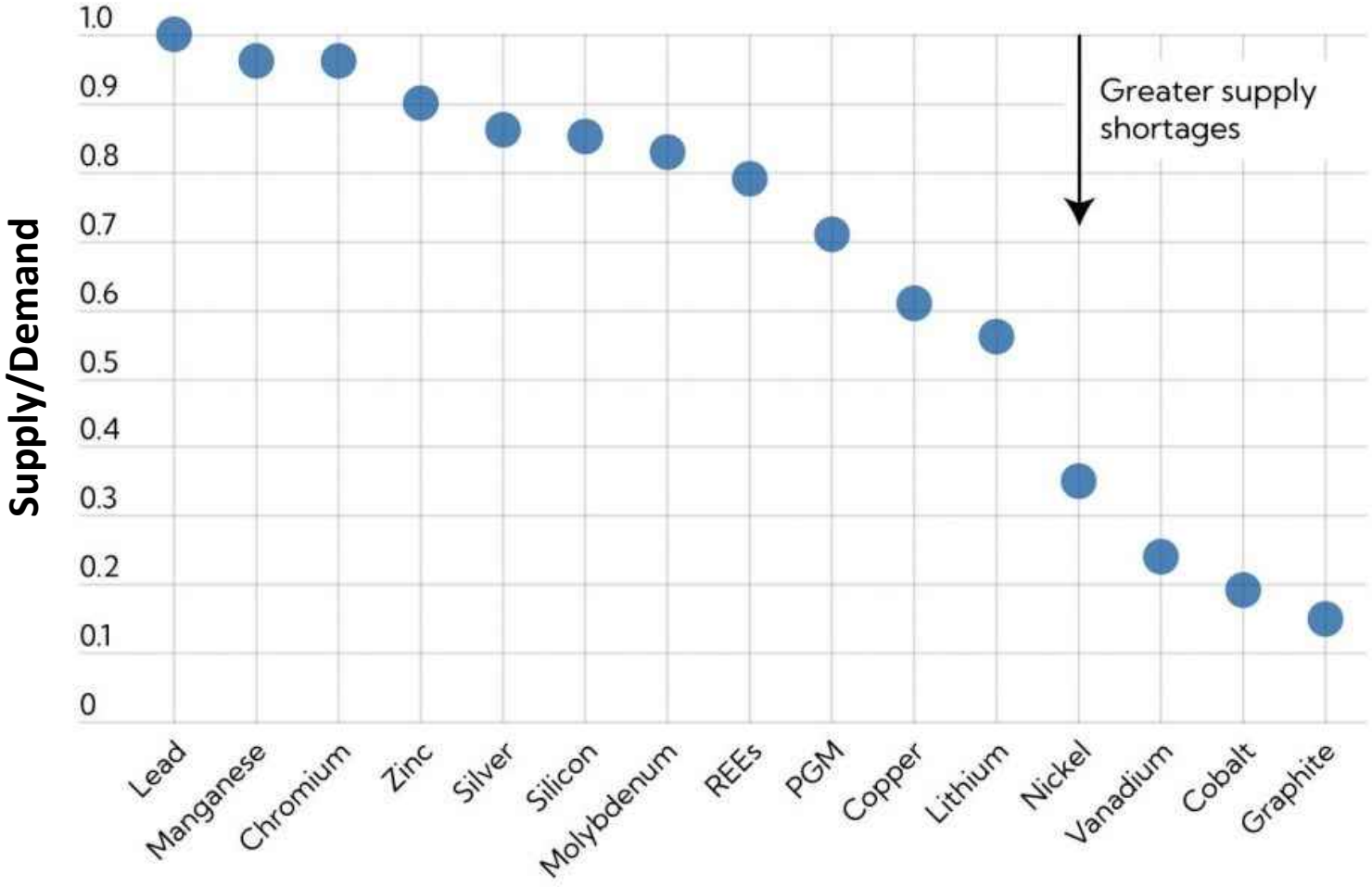
BY RACHEL FRAZIN AND ZACK BUDRYK - 01/31/23 6:59 PM ET



Proposed annual metal production

320 million pounds copper

Global Demand vs. Supply



Achieving net zero with a combination of photovoltaic solar and wind turbines is not possible.

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Other solutions must be explored.

Impact of recycling on primary mine demand