ELECTRIFICATION

The Key Minerals in an EV Batt

Published 2 days ago on May 2, 2022
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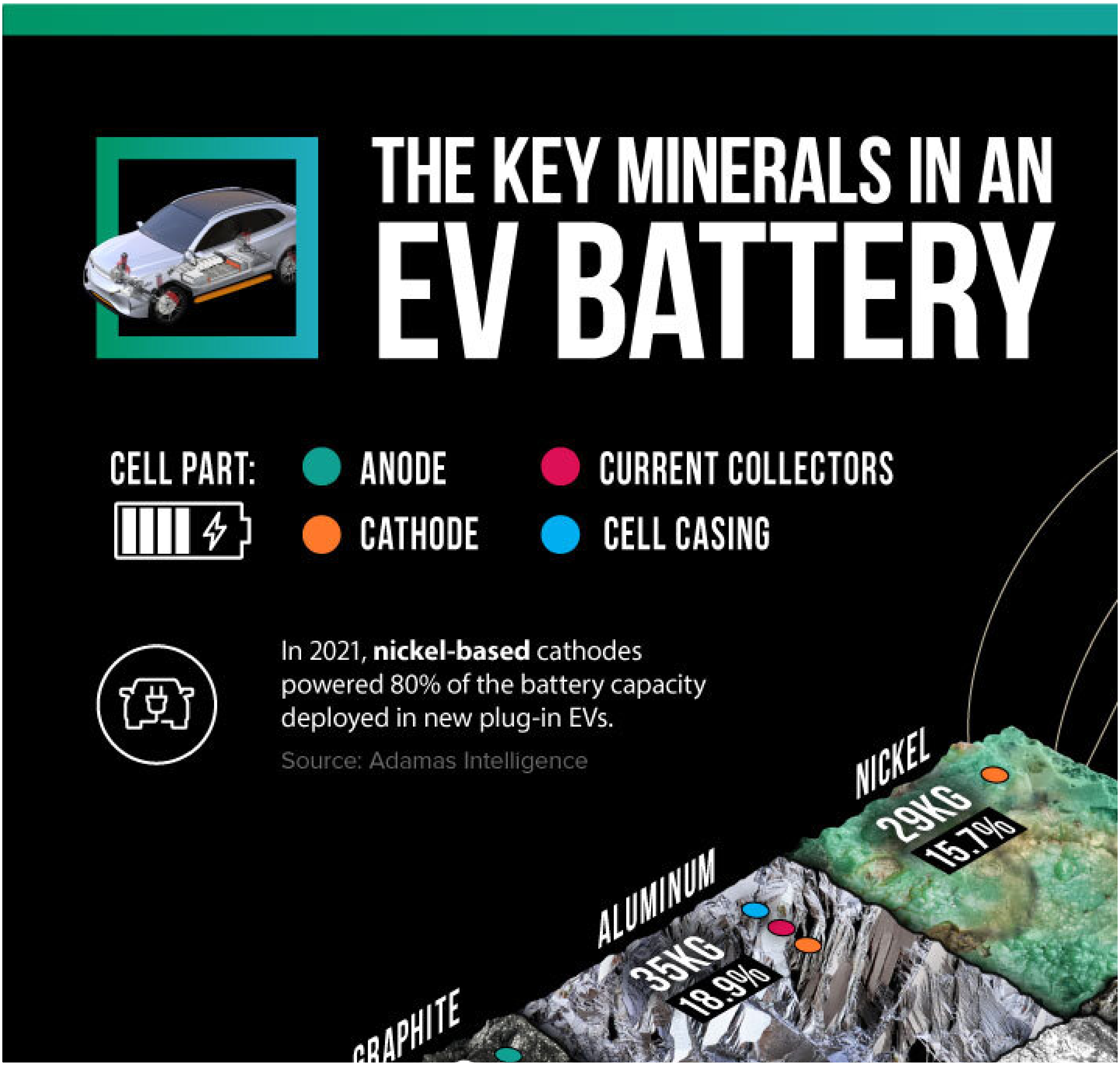
Graphics/Design: **Athul Alexander**



Breaking Down the Key Minerals in an EV Battery

Inside practically every electric vehicle (EV) is a lithium-ion battery that depends on s minerals that help power it.

Some minerals make up intricate parts within the cell to ensure the flow of electrical Others protect it from accidental damage on the outside.

This infographic uses data from the European Federation for Transport and Environm break down the key minerals in an EV battery. The mineral content is based on the 'av battery', which refers to the weighted average of battery chemistries on the market in

The Battery Minerals Mix

The cells in the average battery with a 60 kilowatt-hour (kWh) capacity—the same siz
in a Chevy Bolt—contained roughly **185 kilograms** of minerals. This figure excludes m
the electrolyte, binder, separator, and battery pack casing.

Mineral	Cell Part	Amount Contained in the Avg. 2020 Battery (kg)
Graphite	Anode	52kg
Aluminum	Cathode, Casing, Current collectors	35kg
Nickel	Cathode	29kg
Copper	Current collectors	20kg
Steel	Casing	20kg
Manganese	Cathode	10kg
Cobalt	Cathode	8kg
Lithium	Cathode	6kg
Iron	Cathode	5kg
Total	**N/A**	**185kg**

The cathode contains the widest variety of minerals and is arguably the most importa
expensive component of the battery. The composition of the cathode is a major detern
the performance of the battery, with each mineral offering a unique benefit.

For example, NMC batteries, which accounted for **72%** of batteries used in EVs in 2020
China), have a cathode composed of nickel, manganese, and cobalt along with lithium
nickel content in these batteries tends to increase their energy density or the amount
stored per unit of volume, increasing the driving range of the EV. Cobalt and mangane
as stabilizers in NMC batteries, improving their safety.

Altogether, materials in the cathode account for **31.3%** of the mineral weight in the av
battery produced in 2020. This figure doesn't include aluminum, which is used in nick
aluminum (NCA) cathode chemistries, but is also used elsewhere in the battery for cas
current collectors.

Meanwhile, graphite has been the go-to material for anodes due to its relatively low c
abundance, and long cycle life. Since the entire anode is made up of graphite, it's the s
largest mineral component of the battery. Other materials include steel in the casing t
the cell from external damage, along with copper, used as the current collector for the

Minerals Bonded by Chemistry

There are several types of lithium-ion batteries with different compositions of cathod
Their names typically allude to their mineral breakdown.

For example:

- **NMC811 batteries cathode composition:**
  80% nickel
  10% manganese
  10% cobalt
- **NMC523 batteries cathode composition**:
  50% nickel
  20% manganese
  30% cobalt

Here's how the mineral contents differ for various battery chemistries with a 60kWh

HOW BATTERY CHEMISTRIES DIFFER, BY MINERAL CONTENT

FOR A 60KWH LITHIUM-ION BATTERY

The name of the battery chemistry typically indicates the composition of the cathode.

	NMC811 Nickel (80%) Manganese (10%) Cobalt (10%)	NMC523 Nickel (50%) Manganese (20%) Cobalt (30%)	NMC622 Nickel (60%) Manganese (20%) Cobalt (20%)	NCA+ Nickel Cobalt Aluminum Oxide
LITHIUM	5KG	7KG	6KG	6KG
COBALT	5KG	11KG	11KG	2KG
NICKEL	39KG	28KG	32KG	43KG
MANGANESE	5KG	16KG	10KG	0KG
GRAPHITE	45KG	53KG	50KG	44KG
ALUMINUM	30KG	35KG	33KG	30KG
COPPER	20KG	20KG	19KG	17KG
STEEL	20KG	20KG	19KG	17KG
IRON	0KG	0KG	0KG	0KG

With consumers looking for higher-range EVs that do not need frequent recharging, n cathodes have become commonplace. In fact, nickel-based chemistries accounted for battery capacity deployed in new plug-in EVs in 2021.

Lithium iron phosphate (LFP) batteries do not use any nickel and typically offer lower densities at better value. Unlike nickel-based batteries that use lithium hydroxide com the cathode, LFP batteries use lithium carbonate, which is a cheaper alternative. Tesla joined several Chinese automakers in using LFP cathodes for standard-range cars, dri price of lithium carbonate to record highs.

The EV battery market is still in its early hours, with plenty of growth on the horizon. chemistries are constantly evolving, and as automakers come up with new models wit characteristics, it'll be interesting to see which new cathodes come around the block.

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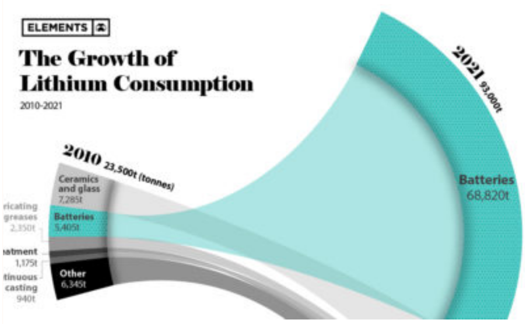

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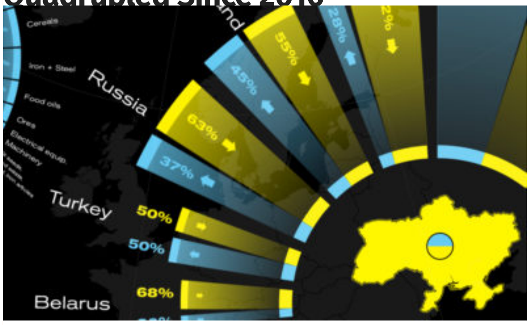

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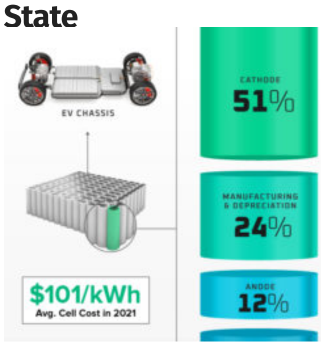

Breaking Down the Cos Battery Cell

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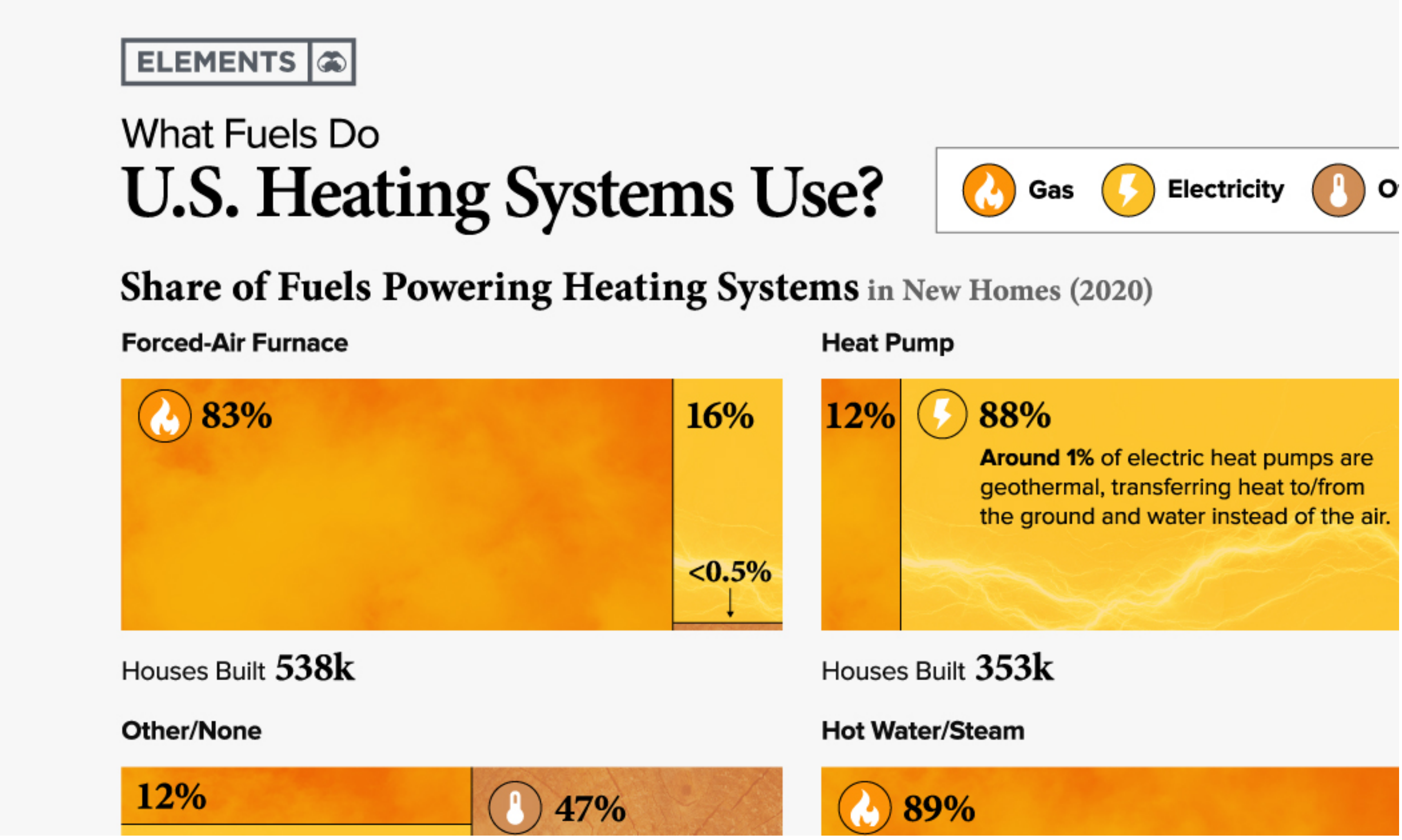
Which fuels do U.S. home heating systems use?

Published 1 week ago on April 25, 2022
By **Omri Wallach**



Charted: Home Heating Systems in the U.S.

Fossil fuel combustion for the heating of commercial and residential buildings ac for roughly 13% of annual greenhouse gas emissions in the United States.

Decarbonizing the U.S. economy requires a switch from fossil fuel-combusting he solutions to renewable energy sources that generate electricity.

Currently, the majority of new homes in the U.S. still combust natural gas for hea through forced-air furnaces or boilers. Just like cars need to be electric, homes w to switch to electricity-powered heating systems that use renewable energy sour

The graphic above uses census data to break down the different heating systems

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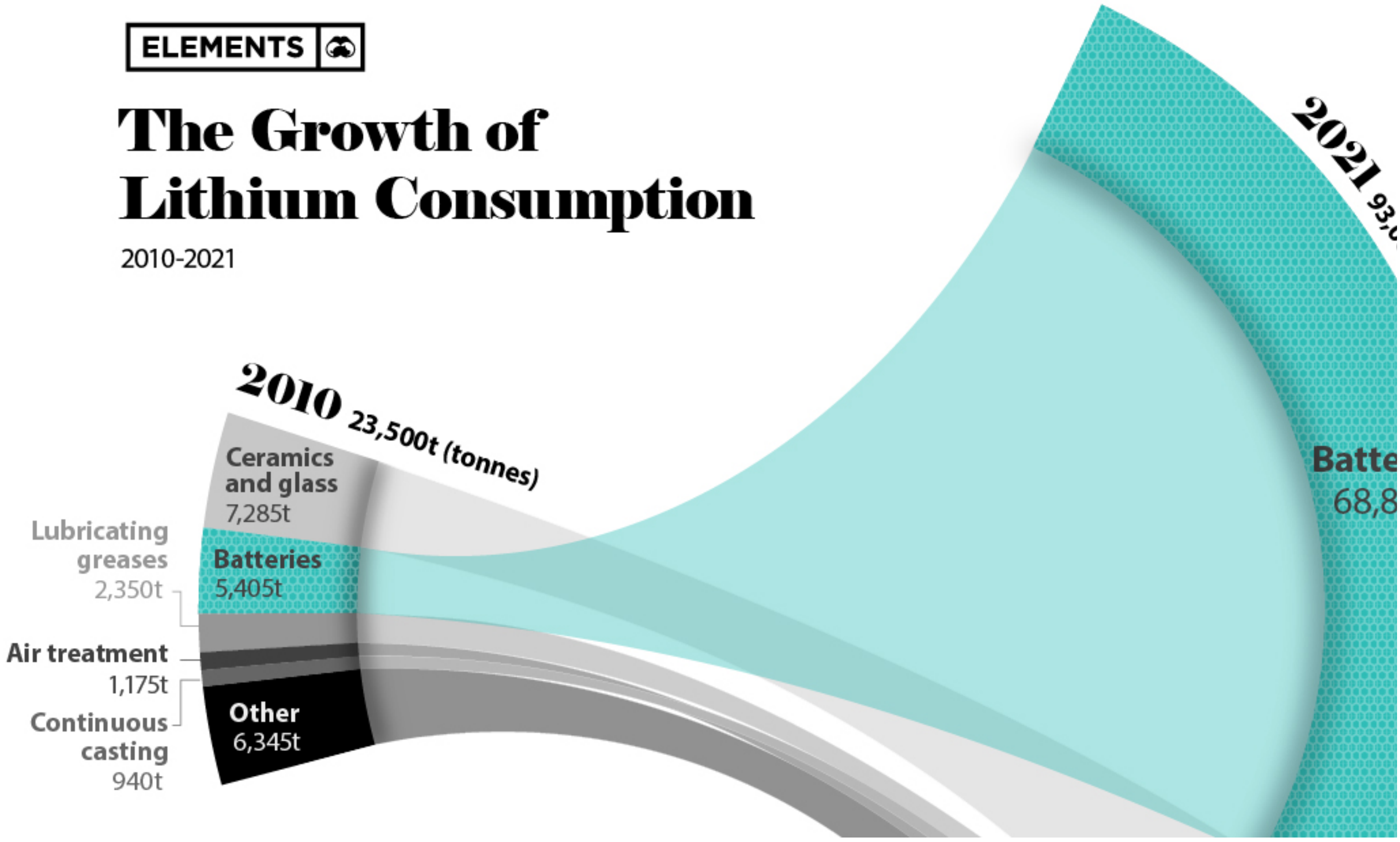
Batteries accounted for 74% of lithium consumption in 2021, up from 23% in 2

Published 3 weeks ago on April 13, 2022
By **Govind Bhutada**



Lithium Consumption Has Nearly Quadrupled Si 2010

Lithium is well-known as one of the key materials behind the lithium-ion batteri power electronic devices, electric vehicles, and energy storage technologies.

Because of its role in clean energy technologies, lithium demand hasn't only incr it has transformed. From primarily being used for ceramics, battery demand has over global lithium consumption and driven an almost four-fold increase since 2

The Impact of EV Batteries

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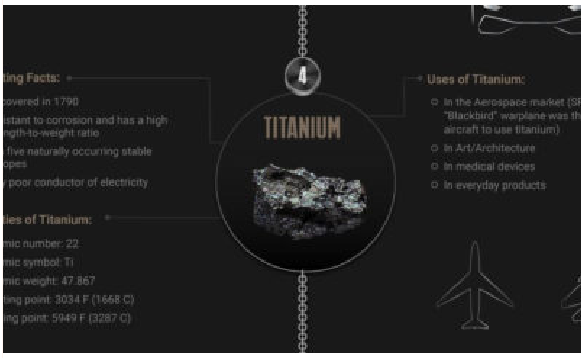

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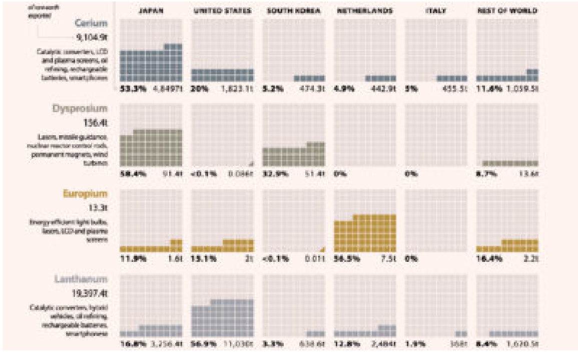

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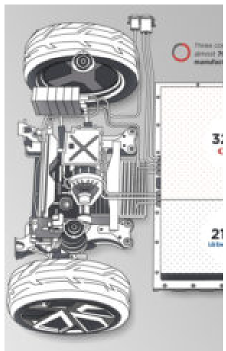

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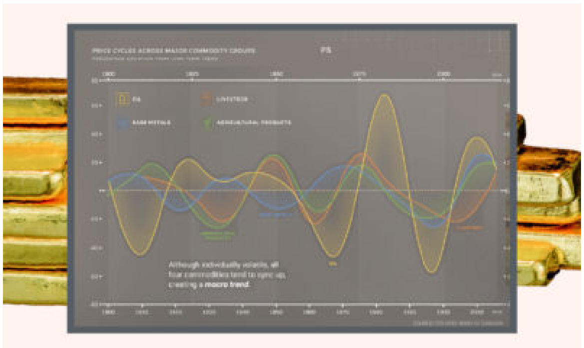
Ranked: The T Manufacturers



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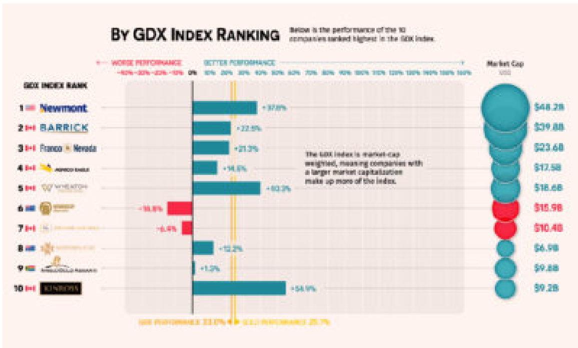

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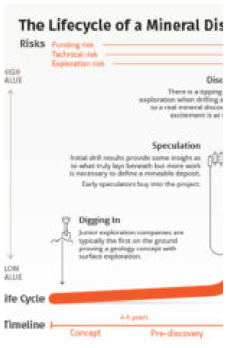

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