VISUALCAPITALIST

GRAPHITE

The Driving Force Behind Green Technology

LOMIKO METALS

6 C Carbon

15th most abundant element in the Earth's crust

Carbon occurs naturally in **3** forms:

- DIAMONDS
- AMORPHOUS — Coal, charcoal, etc
- GRAPHITE

GRAPHITE FACTS

Highest natural strength / stiffness of any material	Lightest weight of all reinforcements	Corrosion and heat resistant	An excellent conductor of electricity and heat	An excellent lubricant

Demand for flake graphite is being driven upwards by green technology

GRAPHITE Occurs in **3** forms:

- FLAKE
- Lump / Vein
- Amorphous

THE GRAPHITE MARKET

SUPPLY

70% of the world's graphite market.

40% Flake Graphite

60% Amorphous Graphite

Highest price Lowest supply

High purity crystal flake graphite supply is very limited. Only this kind of natural graphite can be used for Li-ion batteries, fuel cells, and other green tech.

High Carbon Purity — Large Flake Size

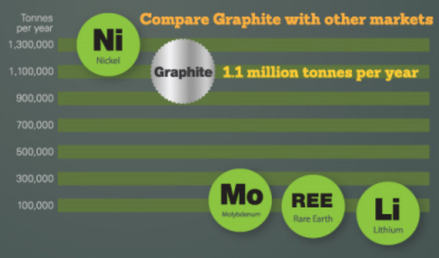
Carbon Flake Purity directly affects the price of the resource

DEMAND

5% growth in the last decade.
Driven by Asian steel and auto markets

USD $12,000,000,000
(Estimated worldwide Graphite market in 2011)

Compare Graphite with other markets



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GREEN TECHNOLOGY

DRIVING GRAPHITE DEMAND

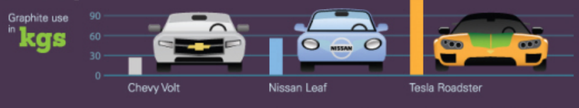
LITHIUM ION BATTERIES

Lithium ion batteries are found in many modern electronic devices.

In a Li-ion battery, graphite is used as the anode.

In the near future, use of electric cars will increase dramatically. **Electric car batteries** contain a significant amount of graphite.

For example:



FACT

There is actually **10–20x** more graphite in a Lithium Ion battery than Lithium

15g The amount of graphite in a smartphone battery

3 MILLION* The number of electric vehicles expected to be in use by 2017

FUEL CELLS

Fuel Cells have the potential to use as much graphite as all other uses.*

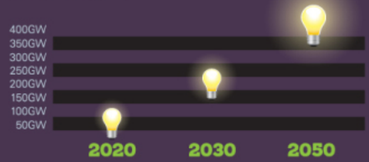
Proton Exchange Membrane technology requires large amounts of graphite, and is the most likely technology to be developed for use in light vehicles, buildings, and smaller applications.†

*US Geological Survey
†US Department of Energy

NUCLEAR POWER

China is currently developing and testing **Pebble Bed reactor designs.*** In April 2011, China began building a 210 MW fourth-generation nuclear reactor using high temperature gas-cooled Pebble Bed technology.

CHINA is aiming to exponentially expand its nuclear power program:



FACT

A 1GW Pebble Bed Reactor needs 3,000 tonnes of graphite to start up and up to 1,000 tonnes to operate annually

GRAPHENE

Graphite flakes are made of many layers of **graphene** stacked on top of each other, with weak bonds holding them together.

Carbon atoms arranged in a honeycomb pattern can be arranged in sheets that are only one atom thick.

1mm is the thickness of **3 million** stacked sheets of graphene

Research has shown that GRAPHENE has unique properties:

- **1000x** the electrical current capacity of Copper wire
- **200x** stronger than structural steel
- **10x** better heat conductivity than Copper
- **20%** flexibility without any damage

Graphene could make technology thinner, transparent, flexible, and more powerful.