



How Strategic is Lithium?

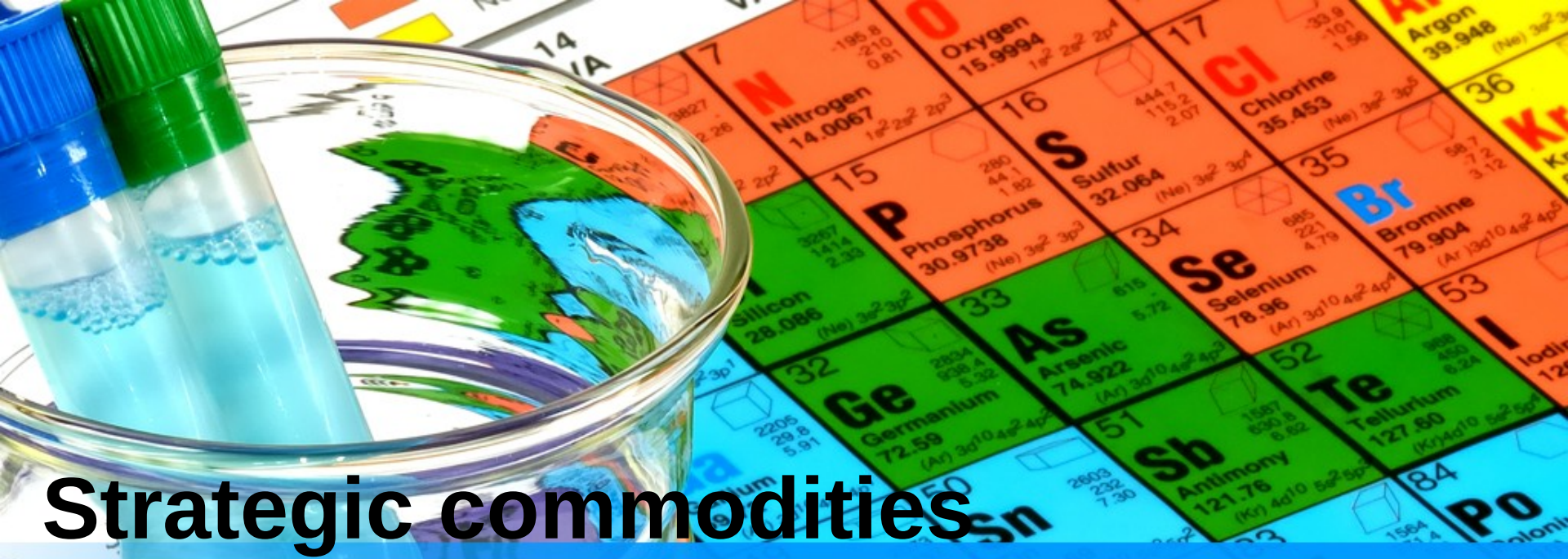
Dr. Gal Luft

Technology and Rare Earth Metals Center

International Lithium Alliance

Institute for the Analysis of Global Security





Strategic commodities



Past-Salt

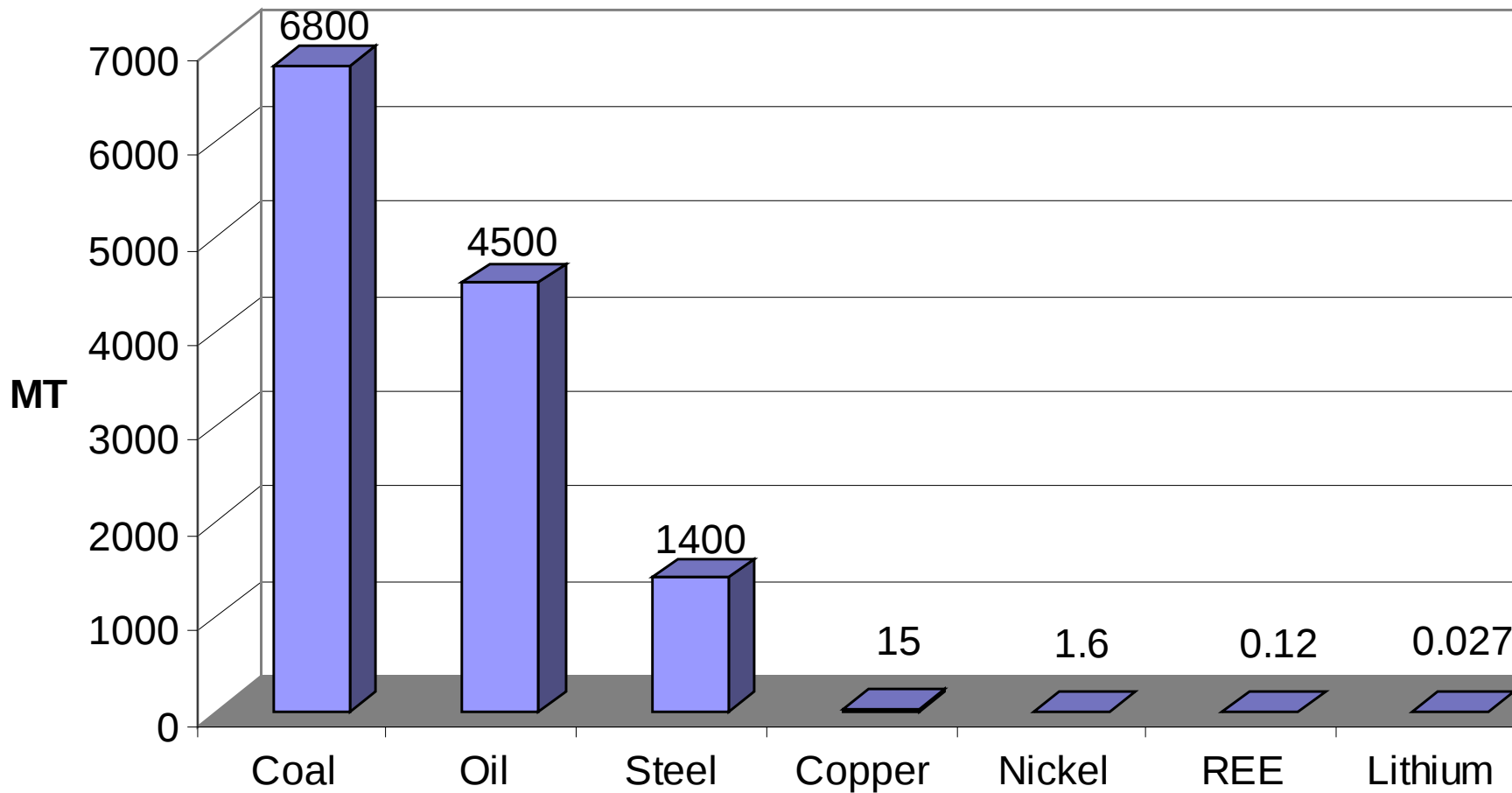


Present-Oil

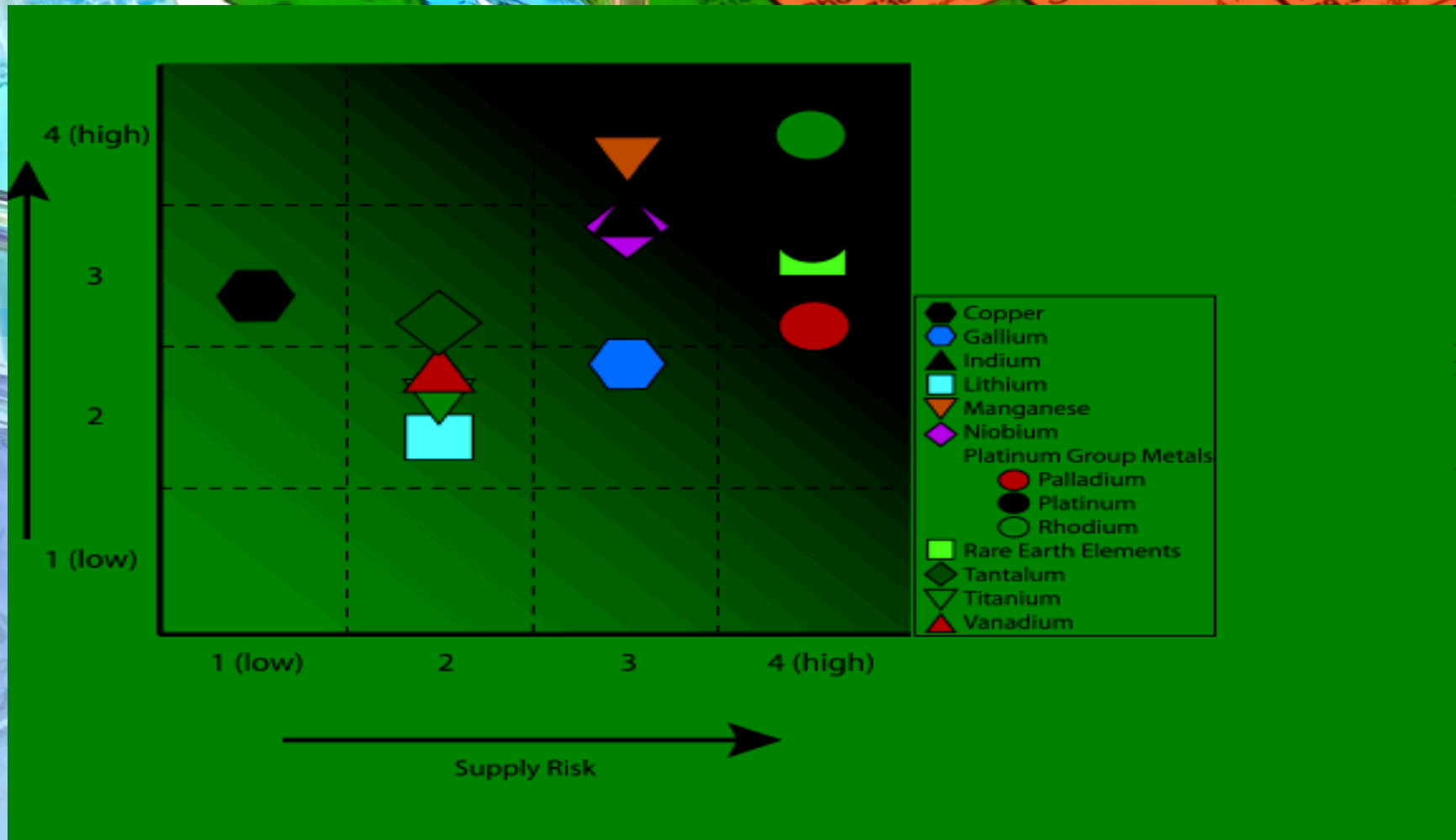


Future-Lithium?

What makes a commodity strategic? Volume?



Criticality of application and vulnerability of supply



t adl ppaf o yıl açtır C



US Government Definitions

Strategic Materials:

Materials that (A) would be needed to supply the military, industrial and essential civilian needs of the U.S. during a national emergency and (B) are not found or produced in the U.S. in sufficient quantities to meet such need.

Materials critical to national security:

Materials that is (A) essential for defense systems and (B) unique in the function it performs (no viable alternatives)

IN THE US LITHIUM IS NOT CONSIDERED AS EITHER



Recent regulatory developments

- 2007 – The National Defense Authorization Act designated a list of strategic commodities. Li is not one of them.
- 2008 - Strategic Materials Protection Board established in the Pentagon to review criticality and supply vulnerabilities.
- 2009 - The U.S. military added lithium to list of resources it considers for stockpiling in the Defense National Stockpile Center. Adding to the stockpile list requires Congressional approval which normally takes few years.
- 2010 - Formation of government interagency task force to devise technology metals strategy/policy.
- 2010 Formation of the TREM Center



Supply chains are not static!

The story of Rhenium

- In part due to its very high melting point, rhenium is a critical component in nickel-based super alloys, which are capable of functioning under very high stress. These superalloys are used in the jet engines of military aircraft and some of the world's most energy-efficient gas turbines.
- In recent years, as rhenium's use in turbine blades and other applications has grown, its price has increased BY 1000%. GE developed alternative super alloys that use less rhenium. GE has also partnered with the U.S. Navy and leading airlines to recycle turbine blades that contain rhenium. Rhenium's criticality declined.

COULD THIS HAPPEN TO LITHIUM?



Uncertainties of Li demand

- How much Li will be needed per car? EV? PHEV?
- Is Li Ion battery the winning chemistry?
- If so, which specific Li chemistry will gain prominence? Li Manganese Oxide? Li Nickel Oxide? Li Iron Phosphate?
- What will be the price of oil?
- Will there be price on carbon?
- Other bottleneck in battery manufacturing.
- Will fuel cells disrupt?
- Will there be significant progress on fusion?
- When will recycling kick in?
- Will space travel and new aircraft models add to demand?
- Will utilities develop storage capacity?
- Unforeseen game changers?



PHEV vs. EV

	Chevy VOLT	Nissan Leaf
Electric range	40 miles	100 miles
Charge time	4 hours	8 hours
Price	\$41,000	\$32,780
Battery	16kwh	24kwh
Lithium Carbonate requirement	10kg	14kg

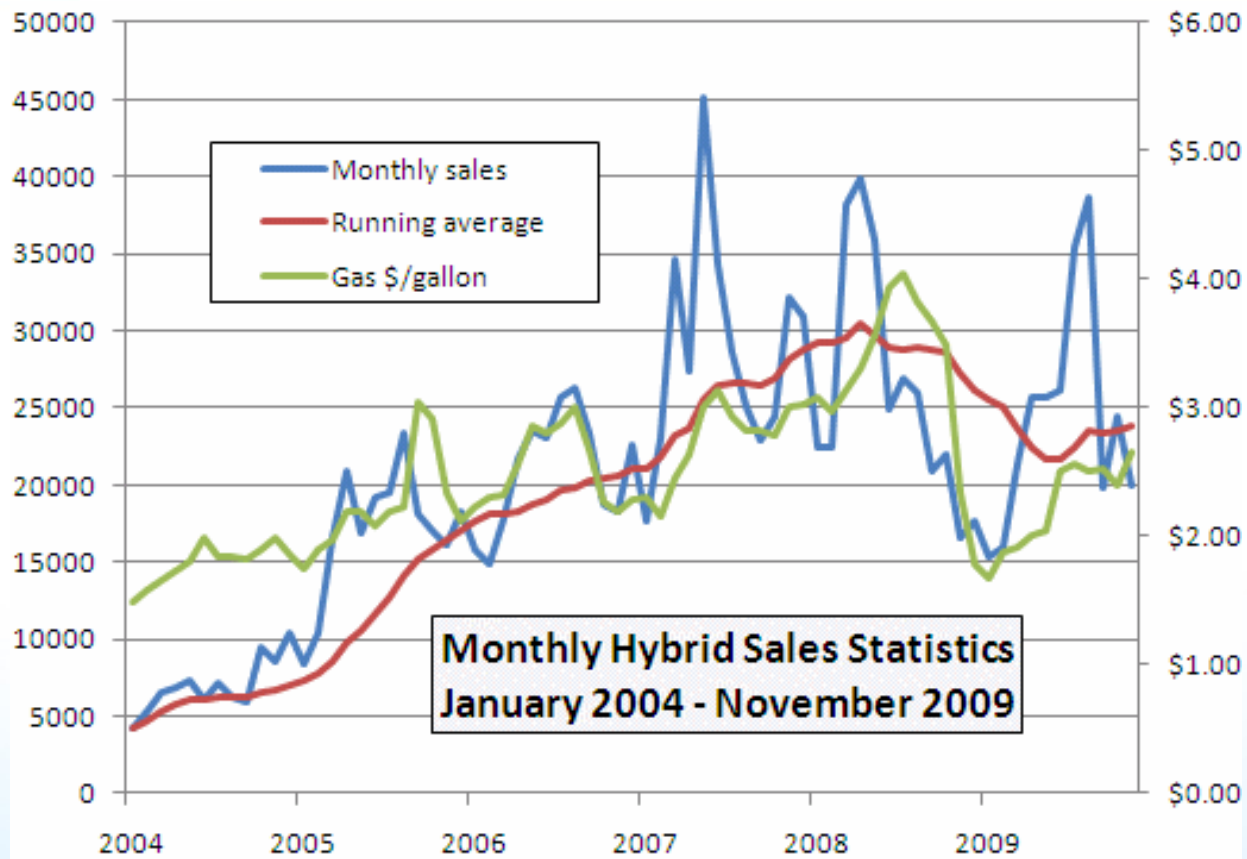


Projections for GEV market penetration are diverse and conflicted

Electrification Coalition	IHS Global Insight	Credit Suisse	U.S. Department of Energy	U.S. National Academy of Sciences
GEV make 25% of sales by 2020 and 90% by 2030	GEV make nearly 20% of sales in 2030	GEV make under 8% of sales by 2030	GEV make 0.86% of sales in 2020 and 2.63% by 2035	GEV make 3% of sales by 2015 and 15% by 2035

GEV = Grid Enabled Vehicle

Gasoline prices drive hybrid sales



GEV penetration will be a function of oil prices.
While we are asleep, OPEC decides.





While Li supply is reliable, battery supply chain faces vulnerabilities which could indirectly impact the Li industry

97% of global Rare Earth Elements production comes from China most of it from the Baiyun Obo mine in Inner Mongolia. Last month China cut export quotas for REE by 72%!

Half of the world's cobalt reserves are in Congo, a country ripped apart by perpetual civil war





Uncertainties of Li supply

- Li is abundant throughout the world. But...
- Not all Li is equal.
- How many “Saudi Arabia’s of Lithium” are out there?
- How many of them are like Afghanistan or Bolivia?
- How many of the 70 or so junior exploration companies will actually become commercial?



New players. Game changers?



Geothermal brines,
The Salton Sea,
Simbol Mining



Hectorite clay, Kings
Valley, Nevada,
Western Lithium



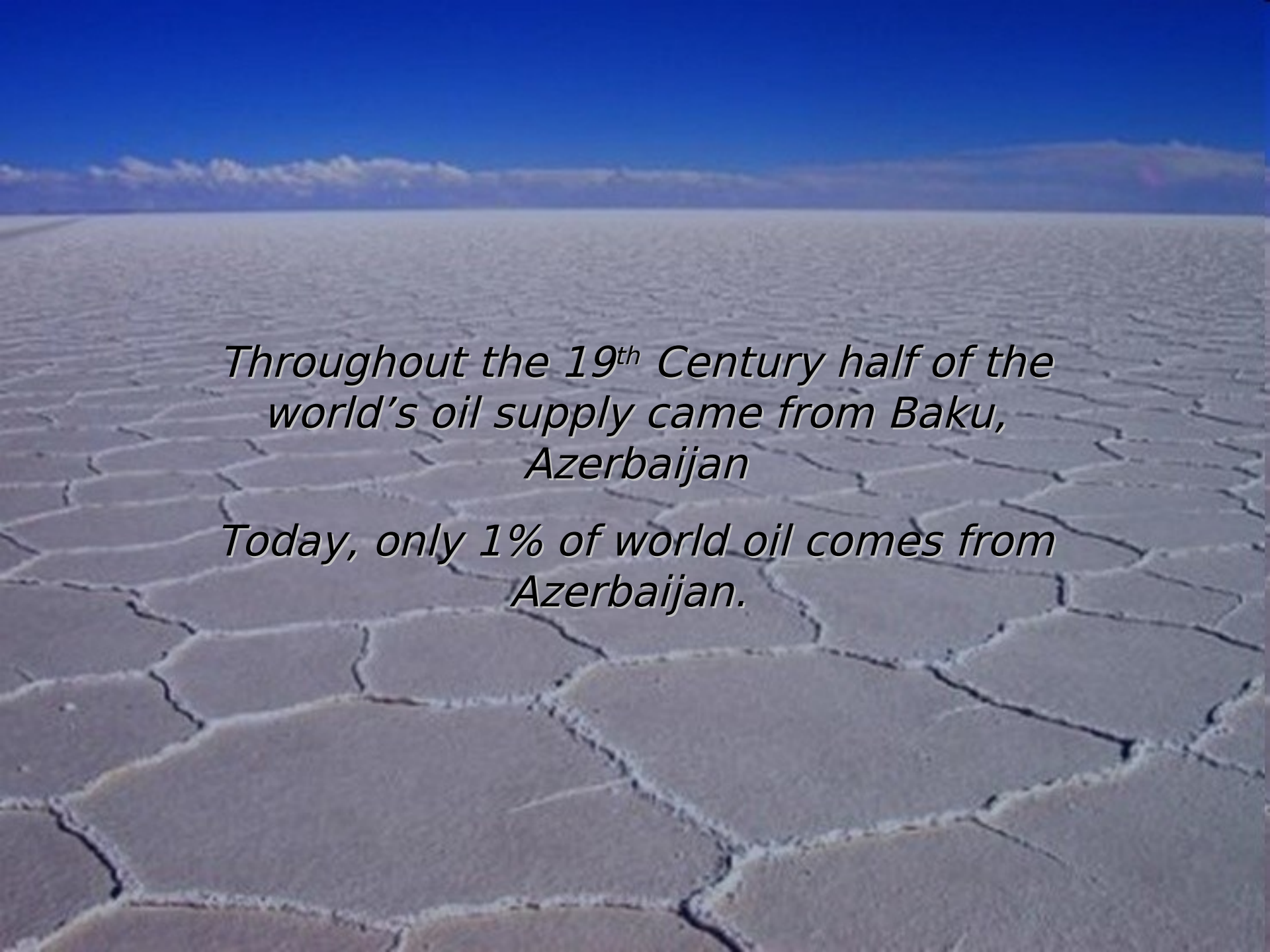
Conclusions

- Li is NOT a strategic commodity and there is no need for government restrictions on production.
- Li is abundant throughout the world and its geographical distribution is balanced.
- Both supply and demand side are marred with uncertainties.
- New resources and production techniques could challenge the uniqueness of Chile's lithium.
- Lack of progress on fusion requires decoupling of the lithium industry from nuclear regulatory bodies.



Closing thoughts

- Among the democratic and open lithium-producing economies Chile is the only country where the industry is government controlled.
- Continuation of the current regulatory environment would cause Chile to lose its competitive edge and miss out on important business opportunity.
- The “Lithium window of opportunity” will not be open forever. Chile will be better off taking advantage of the resource as long as it enjoys a significant competitive edge.



Throughout the 19th Century half of the world's oil supply came from Baku, Azerbaijan

Today, only 1% of world oil comes from Azerbaijan.