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Navigating Uncertainty: A Scenario Analysis of Imported Lithium for EV batteries in the U.S. Under a Chinese Export Ban

PRESENTED BY

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Introduction/ Background

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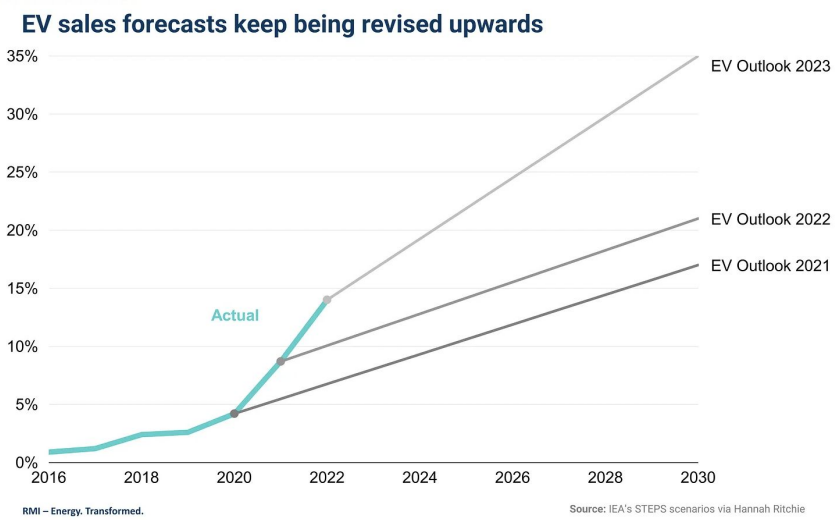
Electrical Vehicles (EVs) Developmen t

- The EV market **surged** over the past decade
  - Nearly **14 millions** of sale
- Growth is expected to **accelerate**
- Expected to reach a revenue of **$156.3 billion** by 2029
- **High demand** on battery-grade **lithium compounds**



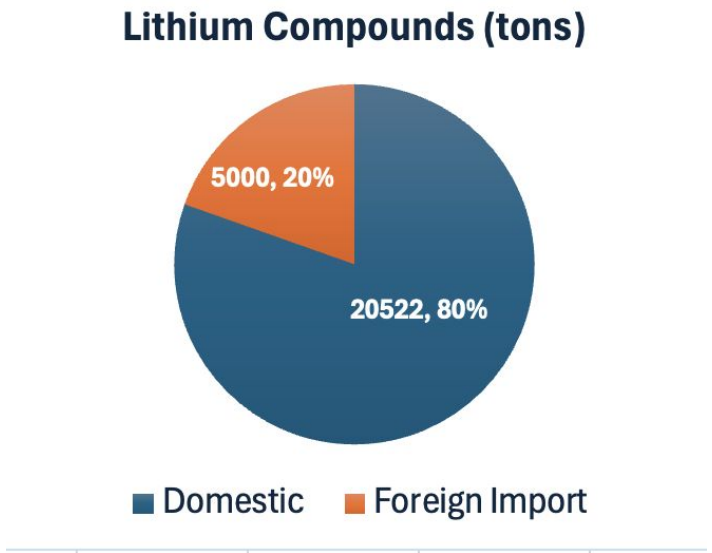
Market Share Projection Graph

Dependency on other countries

- **Limited local manufacturing**
- Highly **dependent on imports** from foreign country

What drives to our scenario analysis?

- **China** being the **top supplier** in the past decade
- Concerns for **growing geopolitical tension** and **trade restrictions**



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Four Objectives

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Objective 1:

Evaluate China's current impact on the U.S. regarding battery-grade lithium compounds.

- Consistently **top 5 supplier**
- Noticeable decline 2020-2022
  - Due to COVID-19 pandemic
- **Strong rebound** in 2023
  - Climb from **rank 7 to 2**

U.S. Imports of **Lithium Hydroxide** (HS Code 2825.20) from China – **2014 to 2023**					
Period	**Exported Country**	**Trade Value (US$)**	**Net Weight(kg)**	**Price Per Unit ($/kg)**	**Rank**
2014	China	$878,965	129,364	$6.79	**2**
2015	China	$1,855,760	242,100	$7.67	**2**
2016	China	$1,459,885	102,490	$14.24	**2**
2017	China	$8,716,624	528,208	$16.50	**2**
2018	China	$5,943,521	312,816	$19.00	**2**
2019	China	$2,122,764	122,800	$17.29	**2**
2020	China	$254,012	24,286	$10.46	3
2021	China	$226,130	22,977	$9.84	5
2022	China	$86,013	1,585	$54.27	7
2023	China	$722,336	17,662	$40.90	**2**

Conclusion:

1. **China** held **key position** in the U.S. lithium supply chain before COVID
2. **China** is **regaining the dominance** after economies are gradually recovering

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Objective 2:

Evaluate the potential impact of a Chinese export ban on lithium price from Chile

- %P_us = 0.0753
  - Meaning that **import price from Chile** to the U.S would **increase by 0.0753**
- Taking **year 2023** as an example
  - **Chile: $50.98/kg**
  - **China: $45.81kg for 26,714kg**
  - **Total extra cost is $3,474,045**

$$\%P_{US} = \frac{\%\Delta Q_{US}}{PES_{Chile} + |PED_{US}|}$$

Partial Equilibrium Price Impact Model

- Estimates the percentage change in price required to **rebalance the shock of supply or demand**

Conclusion:

1. Using **Chile** as an alternative is feasible, but at a **much higher cost**
2. Only feasible as a **short-time strategy**

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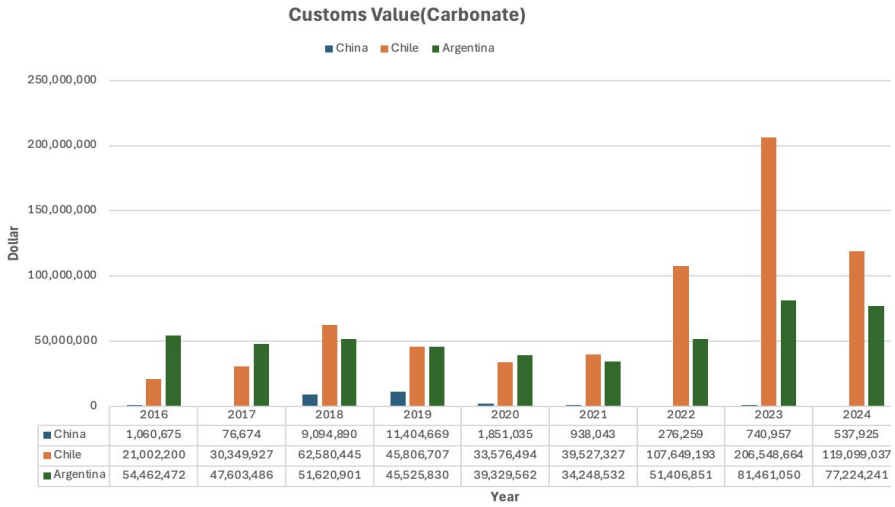
Objective 3:

Identify mitigation strategies for supply chain resilience

Lithium Materials For EV Batteries

	Lithium Material	Primary Source Coun	Importance in EV Batteries
1	Lithium Carbonate (Li_2CO_3)	Chile, Argentina, China	Used in LFP and some NMC batteries
2	Lithium Hydroxide (LiOH)	China, Chile, Australia	Essential for high-nickel NMC/NCA batteries
3	Lithium Iron Phosphate ($LiFePO_4$)	China	Main cathode material for LFP batteries
4	Lithium Hexafluorophosphate ($LiPF_6$)	China, Japan, South Korea	Key lithium salt in electrolytes
5	Lithium Metal (Li)	China, USA	Future solid-state battery material

Lithium materials for EV batteries and the source country



The customs value for the imported lithium carbonate from China, Chile and Argentina (2016-2024)

The U.S. mainly imports lithium carbonate and lithium hydroxide both are **processed heavily in China, Chile, and Argentina**.

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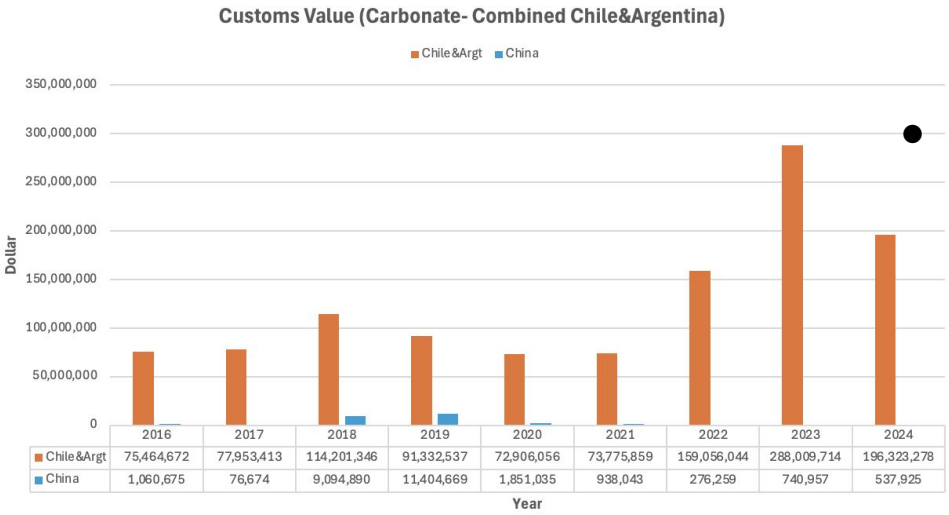
Objective 3:

Identify mitigation strategies for supply chain resilience



	2016	2017	2018	2019	2020	2021	2022	2023	2024
Chile&Argt	75,464,672	77,953,413	114,201,346	91,332,537	72,906,056	73,775,859	159,056,044	288,009,714	196,323,278
China	1,060,675	76,674	9,094,890	11,404,669	1,851,035	938,043	276,259	740,957	537,925

Comparison of combining the customs value of Chile and Argentina & that of China (2016-2024)

- The custom value (**Chile & Argentina**) is **significantly higher** than that of **China** – two-sample t-test, $p = 0.00098 < 0.05$
- Coupled with their strong and stable export volumes,

→ **Chile and Argentina** are well-positioned to **replace China** as primary suppliers of lithium carbonate

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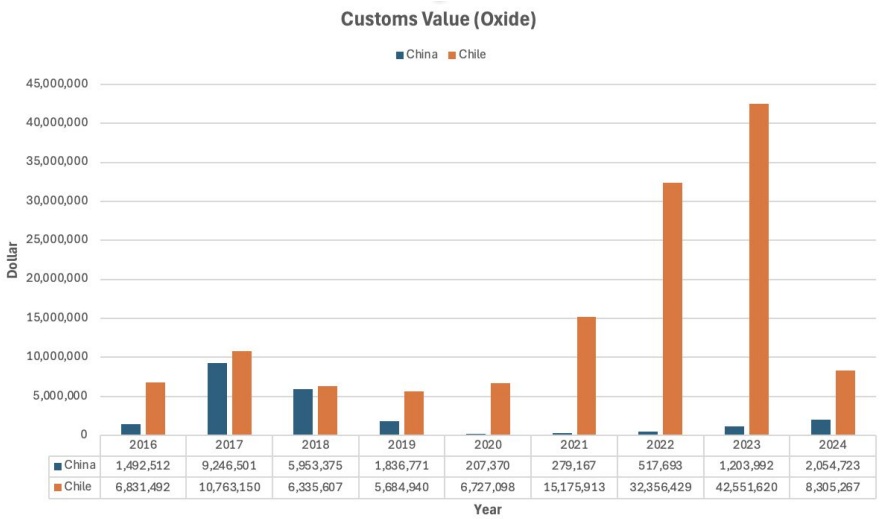
Objective 3:

Identify mitigation strategies for supply chain resilience



The customs value of imported lithium oxide and hydroxide from China and Chile (2016-2024; data for Argentina is not available)

- Since 2019, the customs value of U.S. imports from Chile has **surpassed China's,**

  → Growing U.S. reliance on Chile for lithium oxide and hydroxide.

- Thus, **Chile** appears **capable of replacing China**
- **However**, there are **other key compounds** to consider (lithium iron phosphate (LFP), lithium hexafluorophosphate ($LiPF_6$), lithium metal)

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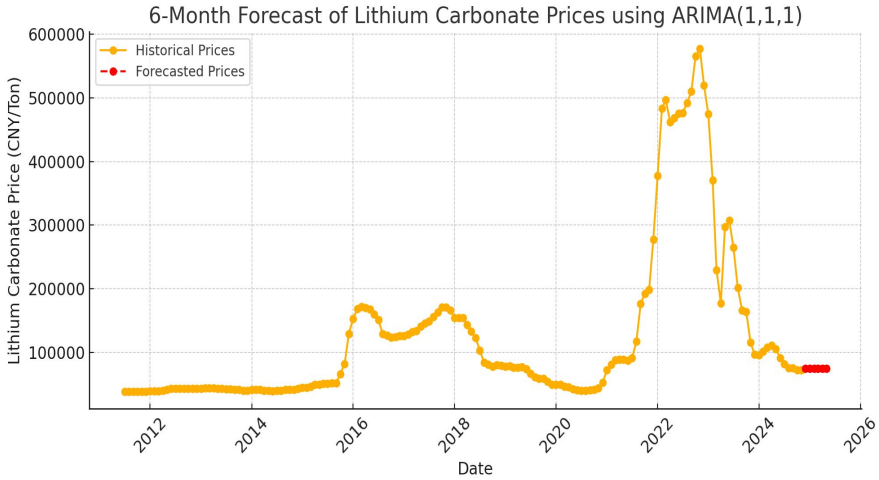
Objective 3:

Identify mitigation strategies for supply chain resilience



Predicted Using ARIMA (1,1,1)

- **AR (1)**: uses one past value to predict the present,
- **I (1)**: differences the data once to stabilize it,
- **MA (1)**: includes one past forecast error to improve

- Lithium carbonate prices are expected to **stabilize** at around 74,800 CNY per ton over the next six months.
- This trend likely reflects a situation where supply and demand are balancing out.
- **Inventory Management** (Just-in-Time (JIT))
  - **Economic Order Quantity (EOQ)** model helps determine the optimal order quantity that minimizes both ordering and holding costs.

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Objective 3:

Identify mitigation strategies for supply chain resilience

Conclusion:

- Using **Just-in-Time (JIT)** inventory strategies
- **Forward contracts** to manage price risks
- Establish **long-term agreements** with Chile, Argentina

Objective 4:

Analyze alternative lithium supply sources

1) Establish long-term strategic partnership with Chile

- **Joint Investment in Lithium Refining Facilities:** reduce transportation costs and improve processing efficiency.
- **U.S.–Chile Clean Energy Trade Partnership:** fostering cooperation not only in lithium but also in battery manufacturing and recycling
- **Technology Transfer & Skills Development Program:** help both countries improve lithium extraction and refine advanced compounds
- **Tax Incentives or Fast-Track Permits for U.S. Companies Investing in Chile**

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Objective 4:

Analyze alternative lithium supply sources

2) Developing Local Lithium Refining

- The U.S. government should implement **incentive policies** that encourage the growth of the refining sector.
- E.g. **Tax reductions, startup grants, and support with financing and permitting**.

3) Investing in Battery Recycling Programs

- Retired EV batteries can be recycled to **recover lithium** and other valuable materials
- Expanding recycling infrastructure can **reduce dependence on imports** and help build a **circular, long-term supply chain**.

Objective 4:

Analyze alternative lithium supply sources

Conclusion:

- Establish long-term strategic **partnership with Chile**
- Developing **Local Lithium Refining**
- Investing in **Battery Recycling** Programs

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Discussion

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Relations with Current Studies

Our scenario analysis came true!

Based on current **tariff incidents**, two possible situations:

1. Chinese companies **halt exports**
2. The U.S. **stops importing** due to **high import tariffs**

Exclusive: Chinese lithium company halts tech exports as trade tensions build

China hits back at US tariffs with export controls on key rare earths

By **Lewis Jackson, Amy Lv, Eric Onstad** and **Ernest Scheyder**

April 4, 2025 3:40 P M EDT · Updated a month ago

Come to the **same conclusion** ->
U.S. need **alternative resources** to replace supply from China

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Conclusion

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Conclusion:

1. **China has been a top supplier** of lithium to the U.S., especially in non-pandemic years.

2. This study evaluates the **impact of a potential Chinese export ban** on EV battery-grade lithium compounds.

3. If imports from China were halted, the **U.S. could shift to Chile** as an alternative—but at a **much higher cost**.

Conclusion:

4. Relying solely on expensive imports is **not sustainable**, prompting the need for additional mitigation strategies:

- **Building domestic refining capacity**
- **Forming long-term trade agreements with Chile**
- **Investing in battery recycling**

5. A **balanced approach** is recommended:

- **Short-term**: Source lithium from Chile
- **Long-term**: Invest in U.S. infrastructure and deepen cooperation with Chile

Limitations

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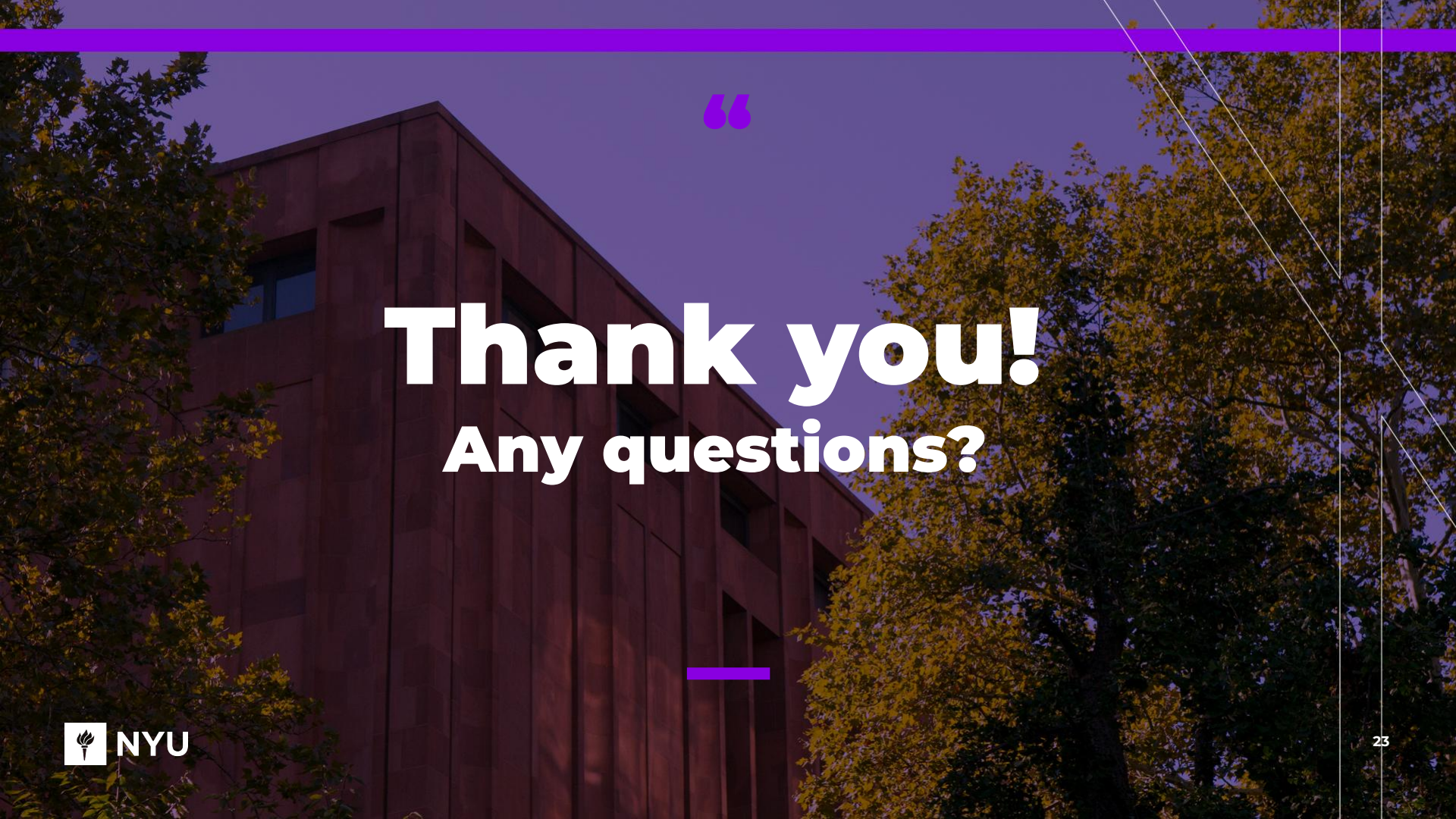
Limitations:

- Focuses on **battery-grade lithium carbonate and hydroxide** (≥99.5% purity).
- **Raw lithium** and other battery materials like **cobalt and nickel** not included.
- **Data gaps**: Some trade and price data are **outdated or restricted**.
- Assumes **Chile can scale up**, but **logistics and politics** may interfere.
- **Geopolitical risks** make outcomes uncertain.



Thank you!

Any questions?

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