

# Cracking the Climate-Conscious Hard Commodities Code: Discovering Their True Value

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# Introduction

Time continues to pass, temperatures keep climbing, and more energy companies are embracing clean technology. At the same time, the automotive industry is introducing new renewable energy vehicles. Each day brings new changes and challenges. In this fast-paced climate transition, how long can our traditional equity valuation methods keep up? Especially for hard commodities, which are at the forefront of climate-related risks, could we find a way to help them adapt to these changes?

In this AI-driven world, it's tempting to toss everything into a machine learning "black box". However, that approach seems too "simplistic" for the complexities of hard commodities. We still need traditional statistics and numbers to understand the fundamentals. That's why I've divided this project into three sections, which you'll see in the upcoming slides.

First, we're exploring the **sustainable growth rate**—yes, that small lowercase 'g.' Are you ready?

# Catalogue

**Chapter I: When Traditional Key Inputs Meets Climate Transition**

**1.1 The Sustainable Growth Rate Speaks Up**

**Chapter II: Climate-Driven Earnings Forecasts**

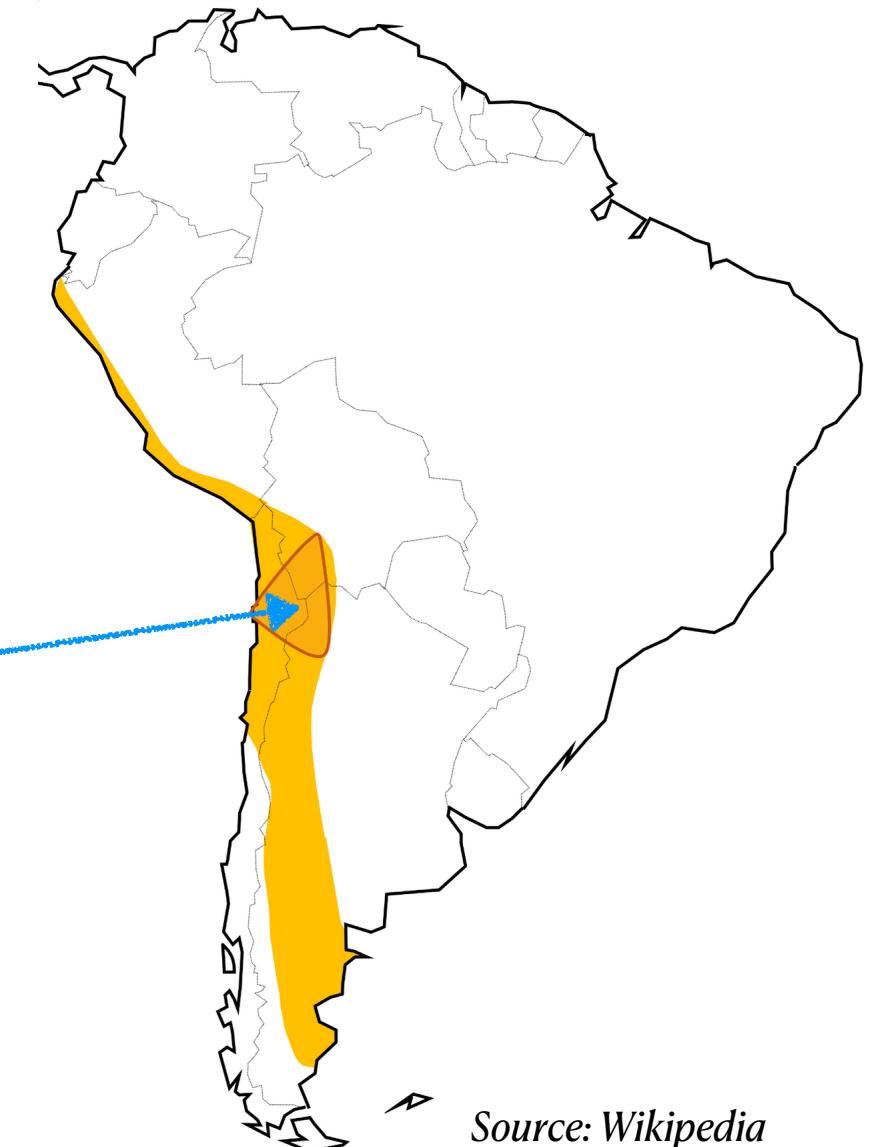
**Chapter III: Adapting Equity Valuation to a Dynamic Climate**

# **1.1 The Sustainable Growth Rate**

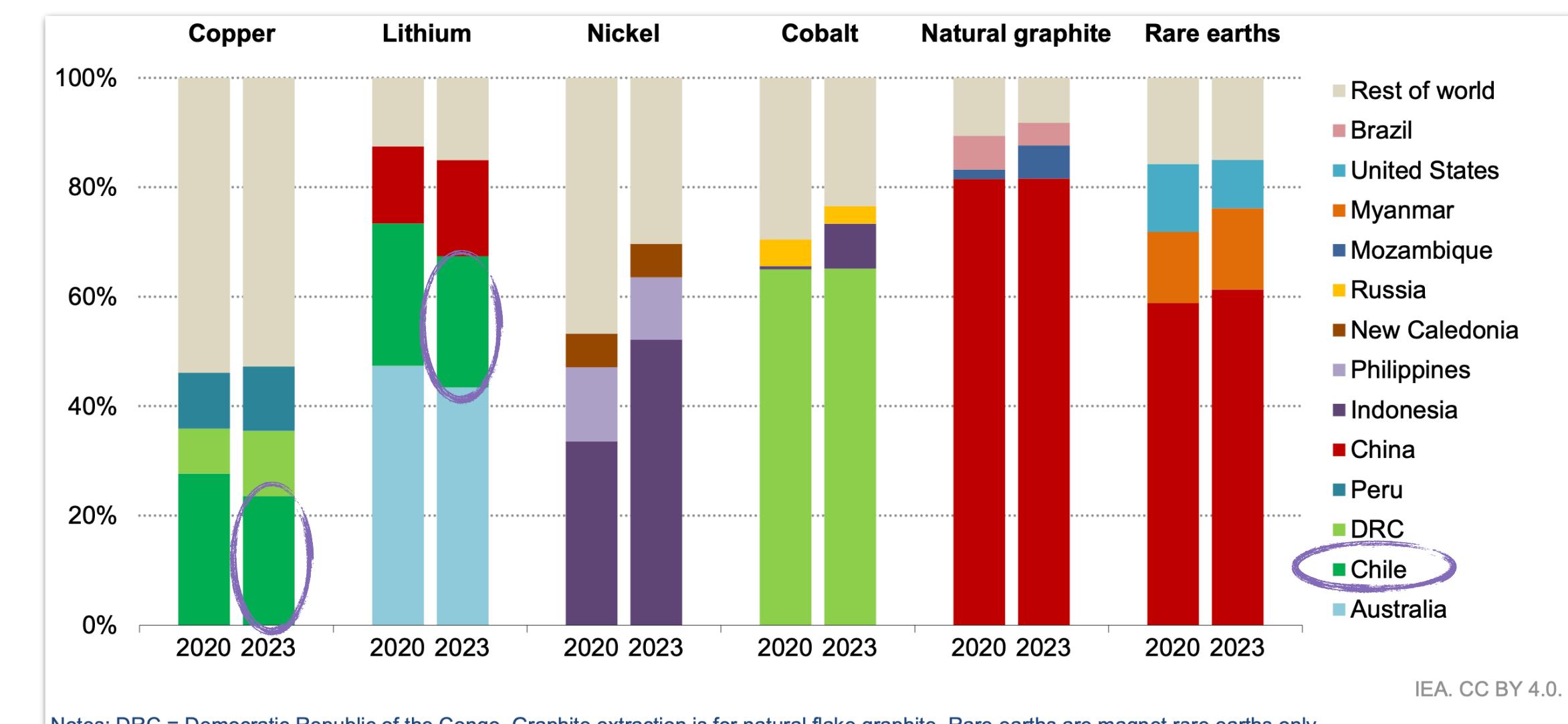
**When the traditional valuation of hard commodities collide with climate change,  
how could we realign with sustainable growth dynamics?**

# Methodology

- **Data Used and Selection**
  - Country: *Chile*
    - holds a leading position in global mining production
  - Critical Minerals: *Lithium & Copper*
    - Chile, a top copper producer and pivotal in the "lithium triangle"
  - Beginning Year (Demand v.s. The sustainable growth rate): 2030 & 2035
    - Assess the impact of starting years on sustainable growth rates, anticipating future tech advancements influencing demand.
  - Data Base: *IEA 2024 Global Critical Minerals Dataset*
- **Analysis Methods**
  - Mathematical Analysis
  - Time Series Analysis
- **Limitations**
  - IEA database predicts from 2030 to 2050 with a 5-year interval
  - 7-year gap between base year (2023) and first prediction (2030) may affect accuracy and reliability of subsequent analyses.



Source: Wikipedia

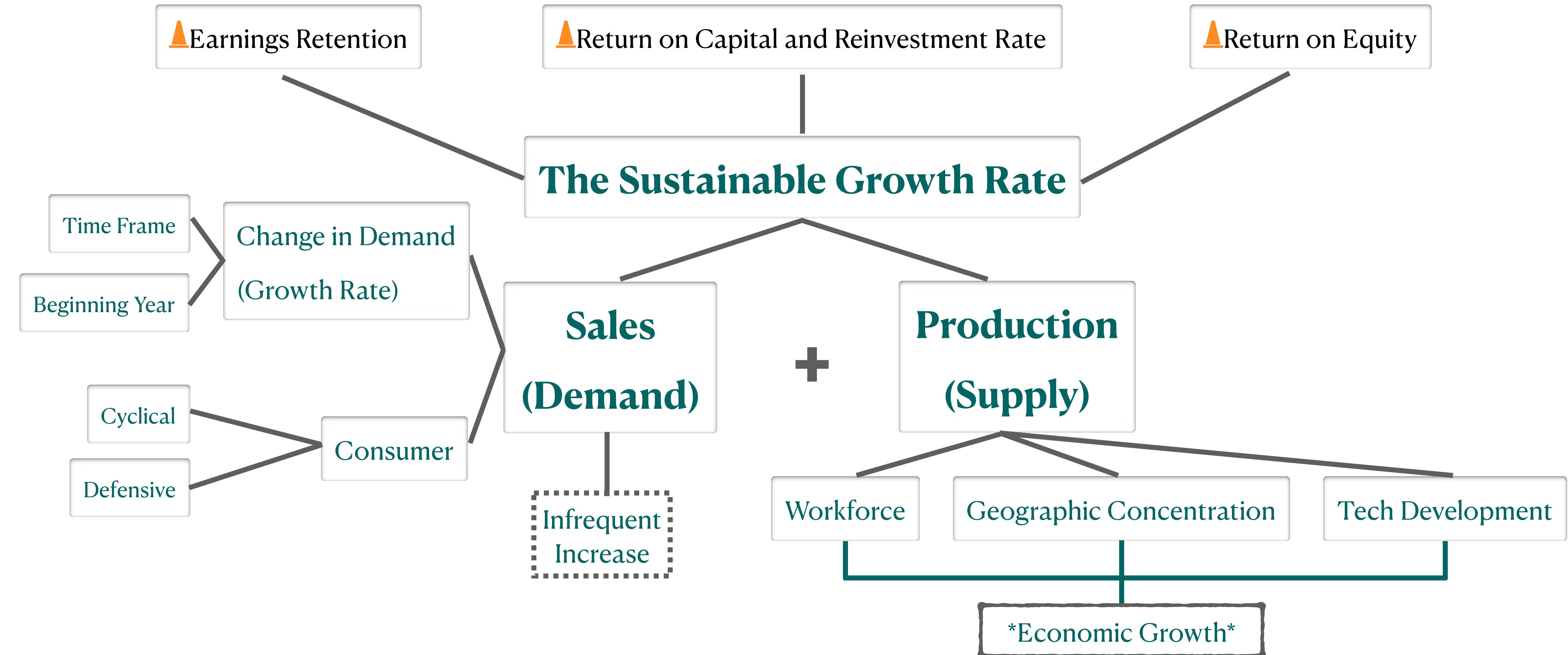


Source: IEA 2024 Global Critical Minerals Outlook

# Key Findings

- The mining sector's stability could be undermined by young workers' disinterest and stagnating labor productivity, posing risks for Chile's future lithium and copper supply chains, emphasizing the considerable role of a stable workforce in maintaining sustainable growth rate projections.
- The *geographic concentration* of raw material exports, such as those from Chile, raises *Scope 3 emissions* from maritime transport, underscoring the necessity of accounting for these concealed costs in sustainable growth rate calculations
- *Strong demand does not ensure sustainable growth rates*, as determining compounded growth requires careful consideration of time frame and beginning year, especially in climate-sensitive sectors (E.g. hard commodities), with noteworthy implications for equity valuation when combined with metrics like FCFF and dividends.
- The pronounced *demand surge*, followed by a hard commodity cooldown during the climate transition, emphasizes the necessity of *excluding* such spikes in forecasting long-term growth rates, often influenced by infrequent factors like policy shifts. Accounting for potential future *technological advancements* is crucial when compounding growth rates from the subsequent period.
- Distinguishing between *cyclical and defensive demand* in hard commodities is required for accurate growth projections.

# Concept Diagram



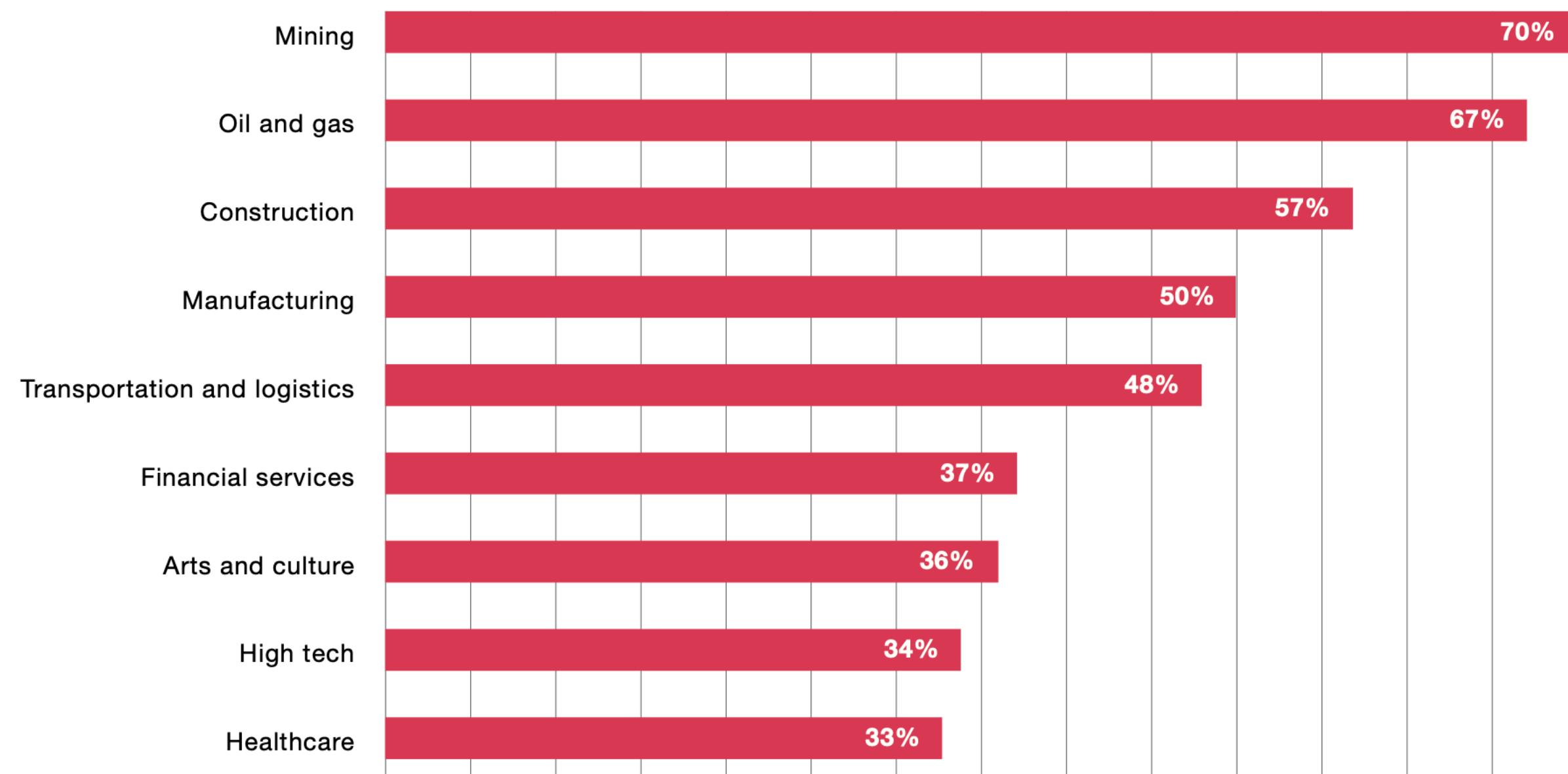
# Workforce: Dynamics

## A Challenge to Future Supply Stability

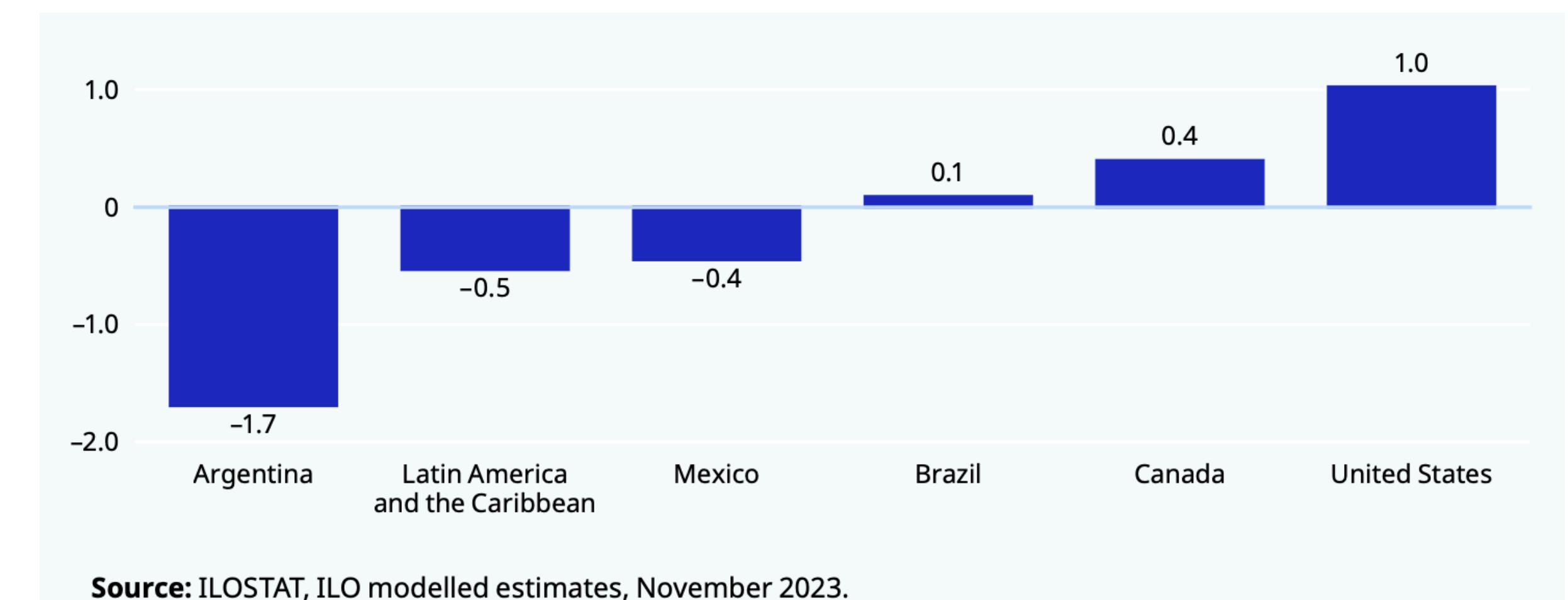
- According to PwC's 2023 Mining Report, mining ranks high on the list of jobs young workers are least interested in. Additionally, the ILO's 2024 World Employment and Social Outlook indicates stagnating labor productivity growth in Latin America and the Caribbean.
- The mining sector's stability could be undermined by young workers' disinterest and stagnating labor productivity, posing risks for Chile's future lithium and copper supply chains, emphasizing the considerable role of a stable workforce in maintaining sustainable growth rate projections.

Young workers are less interested in mining than in other fields

Percentage of respondents who chose 'definitely would not' or 'probably would not' consider jobs in mining and other sectors



Source: PwC, *The Era of Reinvention* (2023 Mine Report)



# Geographic Concentration

## The Hidden Cost of Scope 3 Emissions

- Geographic concentration affects sustainable growth rates via Scope 3 emissions from upstream and downstream activities, highlighting the need to account for hidden costs.
- The GHG Scope 3 calculation method for sea transport (distance-based) reveals that a greater weight of raw materials compared to refined materials, coupled with longer delivery distances, correlates with increased emissions.

Emissions from sea transport

$$= \Sigma (\text{quantity of goods purchased (tonnes)}$$

$$\times \text{distance travelled in transport leg}$$

$$\times \text{emission factor of transport mode or vehicle type (kg CO}_2\text{e/tonne-km)}$$

Source: GHG Technical Guidance for Calculating Scope 3 Emissions

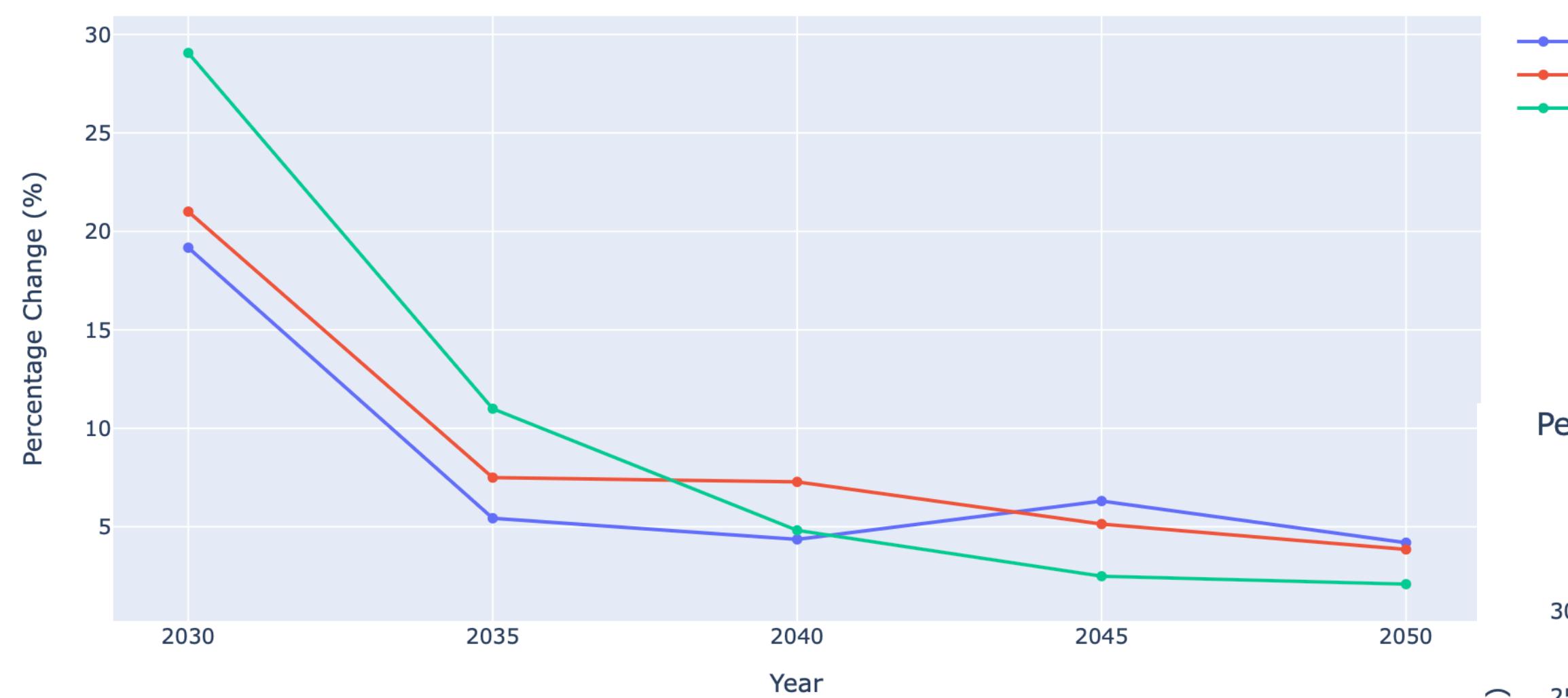


Source: Example export routes from Chile, illustrating Scope 3 emissions by transport distances

# Demand v.s. The Sustainable Growth Rate

The pronounced demand surge, followed by a hard commodity cooldown during the climate transition, emphasizes the necessity of excluding such spikes in forecasting long-term growth rates, often influenced by infrequent factors like policy shifts.

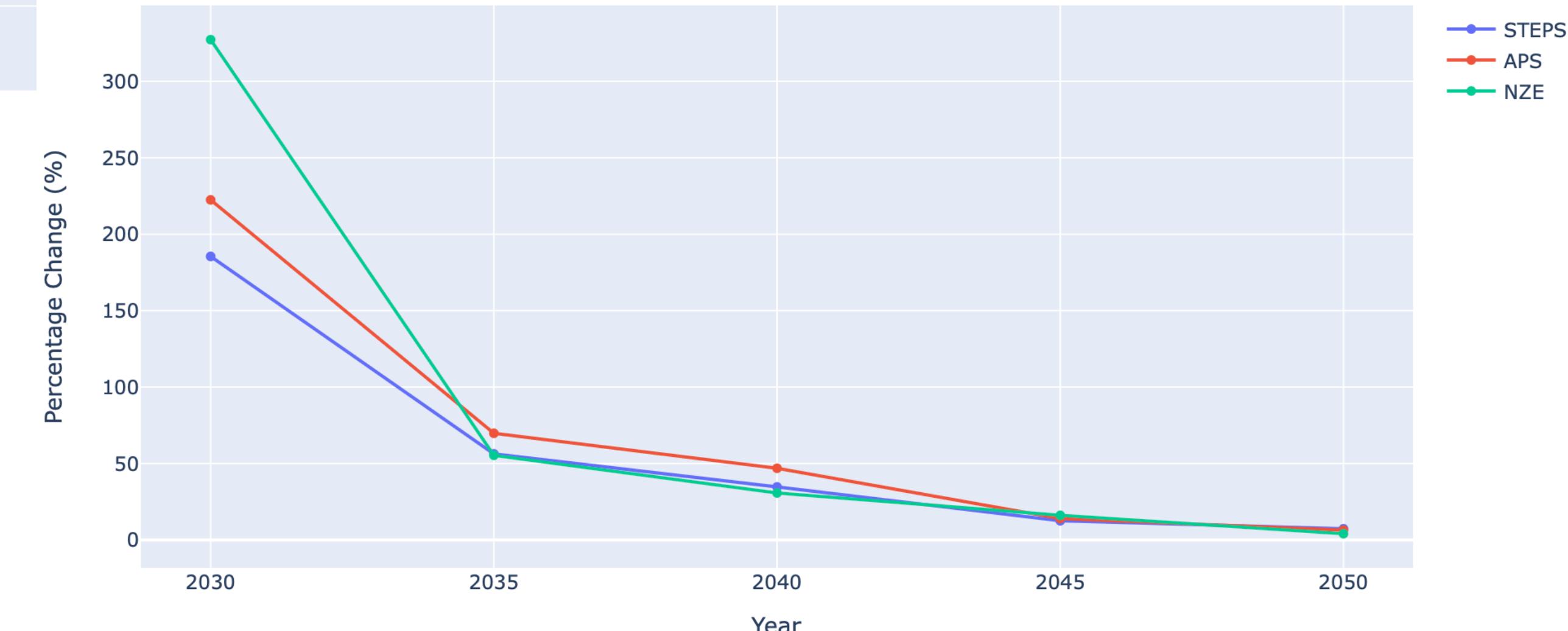
Percentage Change in Total Copper Demand (Per each period)



- Stated Policies Scenario (**STEPS**)
- Announced Pledges Scenario (**APS**)
- Net Zero Emission by 2050 (**NZE**) Scenario

Source: IEA 2024 Global Critical Minerals Outlook

Percentage Change in Total Lithium Demand (Per each period)



Note: Full Analysis Report ([GitHub Link](#))

# Demand v.s. The Sustainable Growth Rate

Distinguishing between cyclical and defensive demand in hard commodities is essential for accurately assessing growth projections, with cyclical demand linked to economic cycles and defensive demand, driven by essential infrastructure and renewable energy, potentially facing slower growth post-project completion.

Copper Demand for key energy transition (kt)						
	Stated Policies scenario					
	2023	2030	2035	2040	2045	2050
<b>Copper</b>						
Total clean technologies	6372	10542	11523	11984	12560	12967
Other uses	19543	20341	21038	21997	23564	24671
<b>Total demand</b>	<b>25915</b>	<b>30883</b>	<b>32561</b>	<b>33981</b>	<b>36124</b>	<b>37638</b>
Share of clean technologies in total demand	25%	34%	35%	35%	35%	34%
<b>Further Analysis</b>						
% Change in Total Demand (Per each period)	19.17%	5.43%	4.36%	6.31%	4.19%	
						21.00% 7.50% 7.28% 5.14% 3.85%
<b>1a) Different Beginning Year, Same Time Periods</b>						
Time Period (Year / Begining at 2030)	NA	5	10	15	NA	
Long term compounded growth rate (g_L)	NA	1.060%	0.960%	1.050%	NA	
		NA	5	10	15	NA
		NA	1.460%	1.440%	1.290%	NA
<b>1b) Different Beginning Year, Same Time Periods</b>						
Time Period (Year / Begining at 2035)	NA	NA	5	10	15	
Long term compounded growth rate (g_L)	NA	NA	0.860%	1.040%	0.970%	
		NA	NA	5	10	15
		NA	NA	2.890%	1.950%	1.550%
<b>2) Different Time Frame, All else equal</b>						
% Change in Total Demand (Same beginning year 2023)	19.17%	25.65%	31.12%	39.40%	45.23%	
Time Period (Year / Begining at 2023)	7	12	17	22	27	
Long term compounded growth rate (g_L)	2.540%	1.920%	1.610%	1.520%	1.390%	
% Change in Growth Rate (Longest to shortest)				-45.28%		-43.12%
		21.00%	30.07%	39.55%	46.71%	52.36%
		7	12	17	22	27
		2.760%	2.220%	1.980%	1.760%	1.570%
		29.06%	43.25%	50.15%	53.89%	57.10%
		7	12	17	22	27
		3.710%	3.040%	2.420%	1.980%	1.690%
						-54.45%

- Different Beginning Year, Same Time Periods:** Long-term sustainable growth rates, calculated from different starting years over the same time periods, show significant variance. This highlights the sensitivity of growth projections to initial conditions and market dynamics.

# Demand v.s. The Sustainable Growth Rate

Strong demand does not ensure sustainable growth rates, as determining compounded growth requires careful consideration of time frame and beginning year, especially in climate-sensitive sectors (E.g. hard commodities), with noteworthy implications for equity valuation when combined with metrics like FCFF and dividends.

## Lithium Demand for key energy transition (kt)

Original Data Source: IEA

	Stated Policies scenario						Announced Pledges scenario					Net Zero Emissions by 2050 scenario				
	2023	2030	2035	2040	2045	2050	2030	2035	2040	2045	2050	2030	2035	2040	2045	2050
<b>Lithium</b>																
Total clean technologies	92	381	627	868	977	1041	442	794	1203	1372	1452	616	986	1308	1522	1573
Other uses	73	90	109	123	138	155	90	109	123	138	155	90	109	123	138	155
<b>Total demand</b>	<b>165</b>	<b>471</b>	<b>736</b>	<b>991</b>	<b>1115</b>	<b>1196</b>	<b>532</b>	<b>903</b>	<b>1326</b>	<b>1511</b>	<b>1607</b>	<b>705</b>	<b>1095</b>	<b>1431</b>	<b>1661</b>	<b>1728</b>
Share of clean technologies in total demand	56%	81%	85%	88%	88%	87%	83%	88%	91%	91%	90%	87%	90%	91%	92%	91%
<b>Further Analysis</b>																
% Change in Total Demand (Per each period)	184.99%	56.14%	34.61%	12.61%	7.24%		221.40%	69.92%	46.83%	13.93%	6.37%	326.55%	55.26%	30.64%	16.07%	4.07%
<b>1a) Different Beginning Year, Same Time Periods</b>																
Time Period (Year / Begining at 2030)	NA	5	10	15	NA		NA	5	10	15	NA	NA	5	10	15	NA
Long term compounded growth rate (g_L)	NA	9.320%	7.710%	5.910%	NA		NA	13.890%	10.900%	8.080%	NA	NA	18.370%	11.750%	8.760%	NA
<b>1b) Different Beginning Year, Same Time Periods</b>																
Time Period (Year / Begining at 2035)	NA	NA	5	10	15		NA	NA	5	10	15	NA	NA	5	10	15
Long term compounded growth rate (g_L)	NA	NA	6.120%	4.250%	3.290%		NA	NA	12.500%	7.460%	5.350%	NA	NA	14.220%	8.480%	5.860%
<b>2) Different Time Frame, All else equal</b>																
% Change in Total Demand (Same beginning year 2023)	184.99%	344.98%	498.98%	574.51%	623.33%		221.40%	446.13%	701.90%	813.63%	871.81%	326.55%	562.27%	765.20%	904.20%	945.07%
Time Period (Year / Begining at 2023)	7	12	17	22	27		7	12	17	22	27	7	12	17	22	27
Long term compounded growth rate (g_L)	16.140%	13.250%	11.100%	9.060%	7.600%		18.150%	15.200%	13.030%	10.580%	8.790%	23.030%	17.060%	13.530%	11.050%	9.080%
% Change in Growth Rate (Longest to shortest)					-52.91%						-51.57%					-60.57%

- Different Time frame, All else equal:** In the IEA's NZE scenario, lithium demand is projected to surge tenfold by 2050 from 2023. While plausible, this forecast faces substitution risks from hydrogen fuel cell vehicles.
- Notably, the growth rate reduction from the longest (27 years) to the shortest (7 years) period is more evident for lithium (60.57%) than for copper (54.45%) under the NZE scenario.

**“Can you guess what key input I'm targeting next?  
Or perhaps you have some even better ideas”**

**From Author**  


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**THANK YOU**