Navigating Thematic Investing in US Infrastructure Development and Commodities

Investor Deck

10 Oct 2023

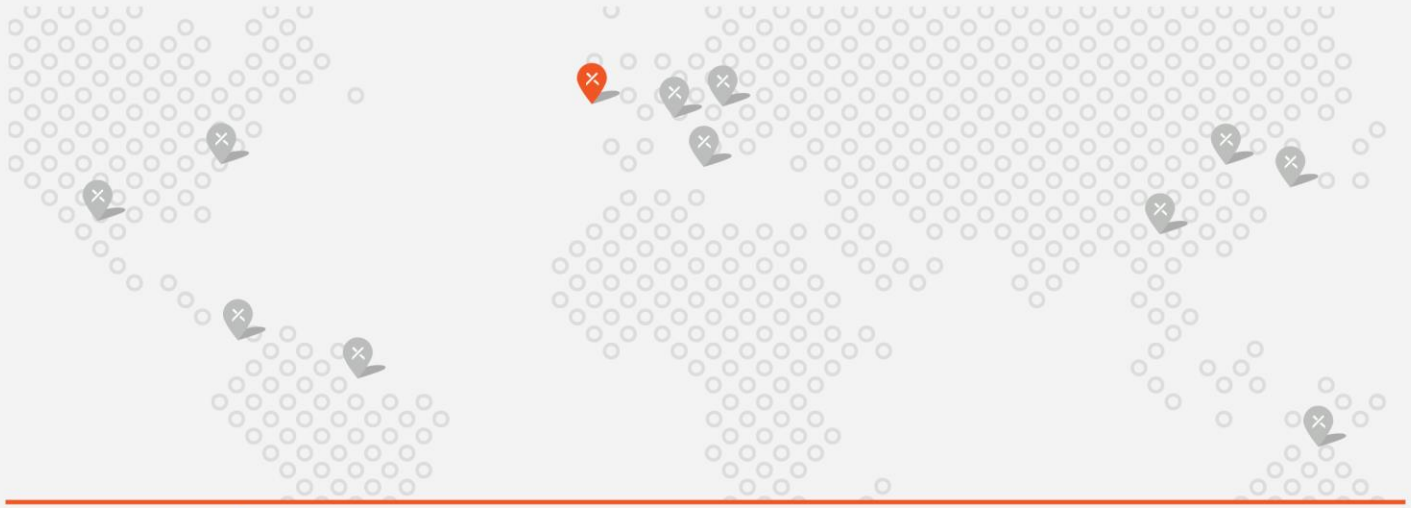
Contents

GLOBAL X
by Mirae Asset

Beyond Ordinary ETFs™

For more than a decade, our mission has been empowering investors with unexplored and intelligent solutions.

Headquartered in New York, with Global X ETFs listed throughout Europe, Asia, Latin America, and Australia.



$49 bn in AUM across more than 200 ETF strategies[1]

Primary Listings by Office

United States
107 ETF Listings

Europe
38 UCITS ETF & 5 Crypto ETPs

Australia
33 ETF Listings

Latin America
31 ETF Listings in Brazil & Colombia

Hong Kong
25 ETF Listings

Japan
32 ETF Listings

MIRAE ASSET
Building on principles

Global X ETFs is a fully-owned subsidiary of Mirae Asset Financial Group, a global industry leader with 51 offices and over 12,000 employees worldwide. Founded in 1997 as one of Asia's pioneering fund management companies, the Group now oversees **$528bn in client assets** across a portfolio that includes real estate, insurance, private equity, and venture capital.[2]

[1]As of June 30, 2023 [2]As of December 30, 2022

Global AUM by Product Category[1]

Income

61 ETFs

Solutions for investors seeking to increase or diversify the yield potential of their portfolio

- United States — 27 ETFs
- Europe — 2 ETFs
- Australia — 9 ETFs
- Latin America — 9 ETFs
- Hong Kong — 4 ETFs
- Japan — 10 ETFs

$20bn

Thematic Growth

119 ETFs

Targeting companies that may be poised to benefit from structural shifts in technology, demographics, and adaptations to the physical environment

- United States — 38 ETFs
- Europe — 26 ETFs
- Australia — 8 ETFs
- Latin America — 16 ETFs
- Hong Kong — 18 ETFs
- Japan — 13 ETFs

$15bn

Commodities

20 ETFs

Exposure to natural resources, primarily in metals, mining and agriculture

$7bn

International Access

30 ETFs

$1bn

Other Strategies

27 ETFs

$2bn

Differentiated Exposures by Region

Sustainable Investing

Digital Assets

Risk Management

Defined Outcome

[1]As of June 30, 2023

Contents

Thematic Investing: Harnessing Disruption in Portfolios

Thematic Investing

Thematic investing brings a rigorous and research-driven approach to harnessing structural changes around the world. It **seeks to identify powerful macro-level trends and the companies that stand to benefit from the materialisation of those trends**.

Process

Top Down
Identify disruptive macro-level trends

Bottom Up
Select investments with high exposure to those trends

Characteristics

- **Long term, growth-focused** strategy
- **Unconstrained** by arbitrary geographic and sector definitions
- **Concentrated** portfolios, often with biases towards US, Tech, and Growth
- **Relatable** concepts that impact our daily lives

The Global X Approach: 3 Key Considerations to Theme Selection

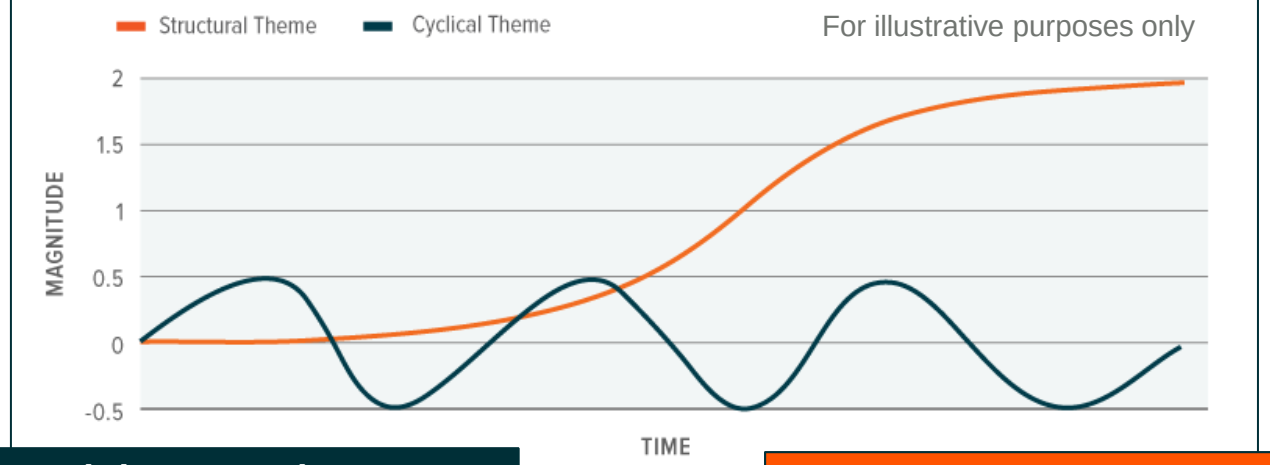
Keys to approaching thematic investing: Look for high conviction themes, investments with high exposure to those themes, and a multi-year time frame.

	Stronger Approach	>	Weaker Approach
Conviction	High, due to observable structural changes in demographics, technology, behavior, or politics/regulations		Limited, due to conjecture and low likelihood of theme materializing
Investability	Broad group of publicly traded companies, with high liquidity, that provide targeted exposure to the theme		Narrow group of companies with low liquidity, and only tangential exposure to the theme
Time Frame	Medium to long term (5 or more years), making market timing less of a factor		Shorter term placing greater importance on timing

Cyclical vs. Structural Themes

Thematic investing is often used to broadly describe a forward-looking investment approach, but it's important to distinguish between two distinct types of themes: cyclical and structural.

Cyclical vs. Structural Themes



Cyclical Themes (Blue Waves)

- Occur at somewhat regular short - or medium-term intervals, typically based on changes in the business cycle
- Can be mean-reverting, so that over a long period of time they tend to converge with some average level
- Examples include asset valuations, volatility, interest rates, and currency values

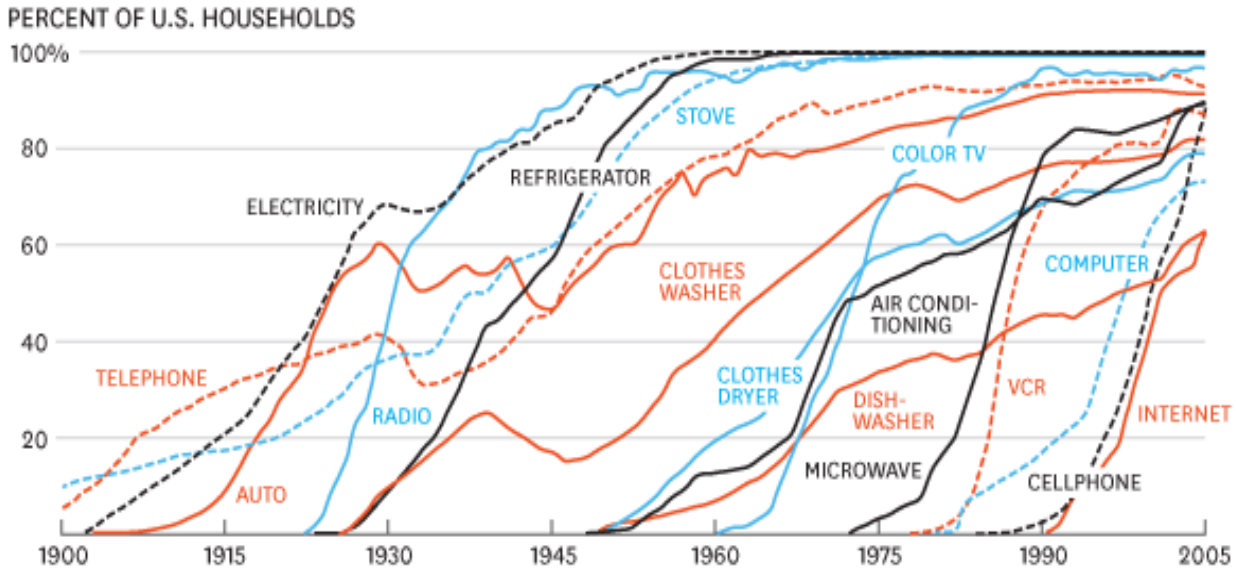
Structural Themes (Orange S-Shape)

- Occur as one-off shifts that change an existing paradigm
- Tend to be longer-term in nature
- Typically driven by powerful forces such as disruptive technologies, changing demographics and consumer behavior, or evolving physical environments

What Does Disruptive Growth Look Like?

Historically, several innovative products followed S-shaped adoption patterns. Recently, adoption has steepened, signaling disruption is occurring at a faster rate.

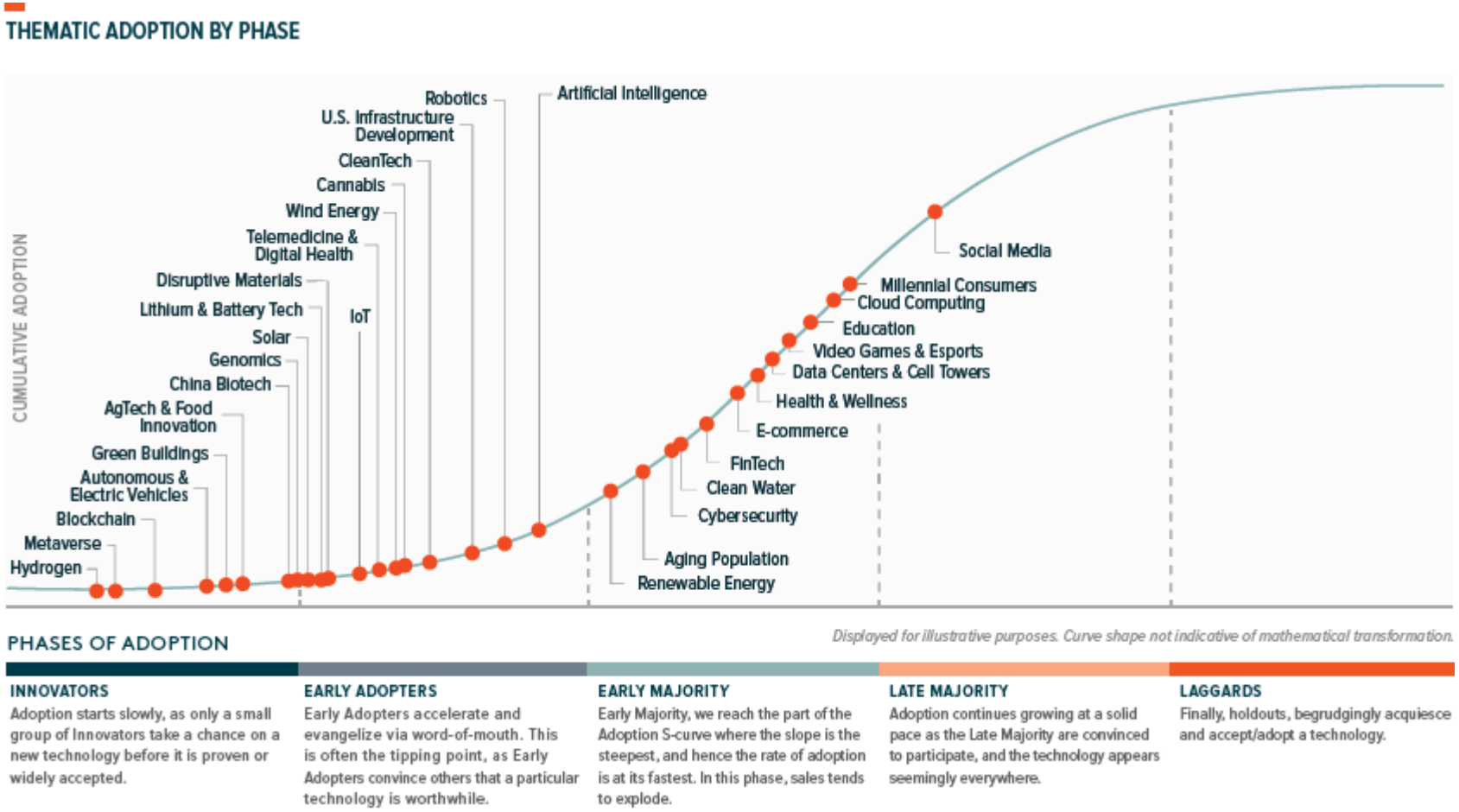
A Historical Look At Adoption



Source: Michael Felton, The New York Times and Harvard Business Review.

Where Do Disruptive Themes Stand?

While each theme follows a unique adoption curve, the chart below estimates the phase of adoption for several themes we cover. Less developed themes plot further to the left on the adoption curve and more established themes plot further to the right on the curve.



Global X's UCITS ETF Suite[1]

Global X offers 26 thematic UCITS ETFs designed to target companies that may benefit from disruptive structural changes in technology and innovation, people and demographics, and the availability of resources

Disruptive Technology

Lithium & Battery Tech UCITS ETF (LITU LN)

FinTech UCITS ETF (FINX LN)

Internet of Things UCITS ETF (SNSR LN)

Robotics & Artificial Intelligence UCITS ETF (BOTZ LN)

Autonomous & Electric Vehicles UCITS ETF (DRVE LN)

Cloud Computing UCITS ETF (CLO LN)

Video Games & Esports UCITS ETF (HERU LN)

Cybersecurity UCITS ETF (BUG LN)

Data Center REITs & Digital Infrastructure UCITS ETF (VPN LN)

Blockchain UCITS ETF (BKCH LN)

China Electric Vehicle and Battery UCITS ETF (CAUT LN)

China Cloud Computing UCITS ETF (CCLD LN)

Physical Environment

U.S. Infrastructure Development UCITS ETF (PAVE LN)

Renewable Energy Producers UCITS ETF (RNRG LN)

CleanTech UCITS ETF (CTEK LN)

Clean Water UCITS ETF (AQWA LN)

Wind Energy UCITS ETF (WNDY LN)

Solar UCITS ETF (RAYS LN)

Hydrogen UCITS ETF (HYGN LN)

AgTech & Food Innovation UCITS ETF (KROP LN)

Disruptive Materials UCITS ETF (DMAT LN)

China Clean Energy UCITS (CCLN LN)

People & Demographics

E-commerce UCITS ETF (EBIZ LN)

Genomics & Biotechnology UCITS ETF (GNOM LN)

Telemedicine & Digital Health UCITS ETF (EDOC LN)

China Biotech UCITS ETF (CBIO LN)

3 Commodities UCITS ETFs, 3 Income UCITS ETFs and 2 Defined Outcome UCITS ETFs

Commodities

Copper Miners UCITS ETF (COPX LN)

Uranium UCITS ETF (URNU LN)

Silver Miners UCITS ETF (SILV LN)

Income

SuperDividend UCITS ETF (SDIV LN)

Nasdaq 100 Covered Call UCITS ETF (QYLD LN)

S&P 500 Covered Call UCITS ETF (XYLU LN)

Defined Outcome

S&P Quarterly Buffer UCITS ETF (SPQB LN)

S&P Quarterly Tail Hedge UCITS ETF (SPQH LN)

[1] As of Sep 2023

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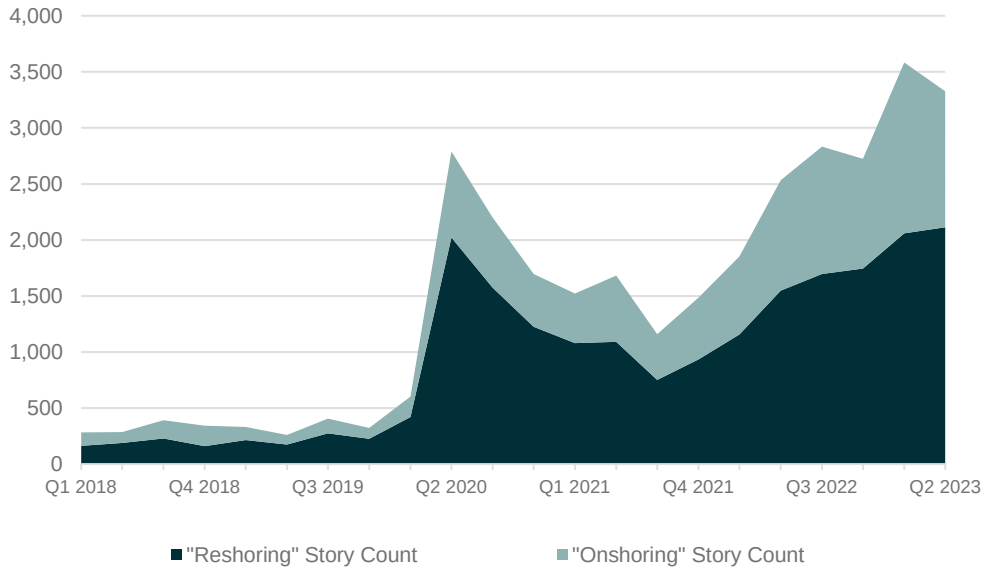
Supply Chain Reshoring Could Boost Domestic Construction

Recent black swan events prompted U.S. companies to reconsider their decentralised supply chains. Many management teams hope to build out domestic manufacturing capacity, which could create opportunities throughout the U.S. infrastructure space.

Supply chain localisation is an increasingly common topic in corporate presentations and news stories. A 2021 survey found that 92% of U.S. executives expressed positive sentiments toward reshoring efforts.[1]

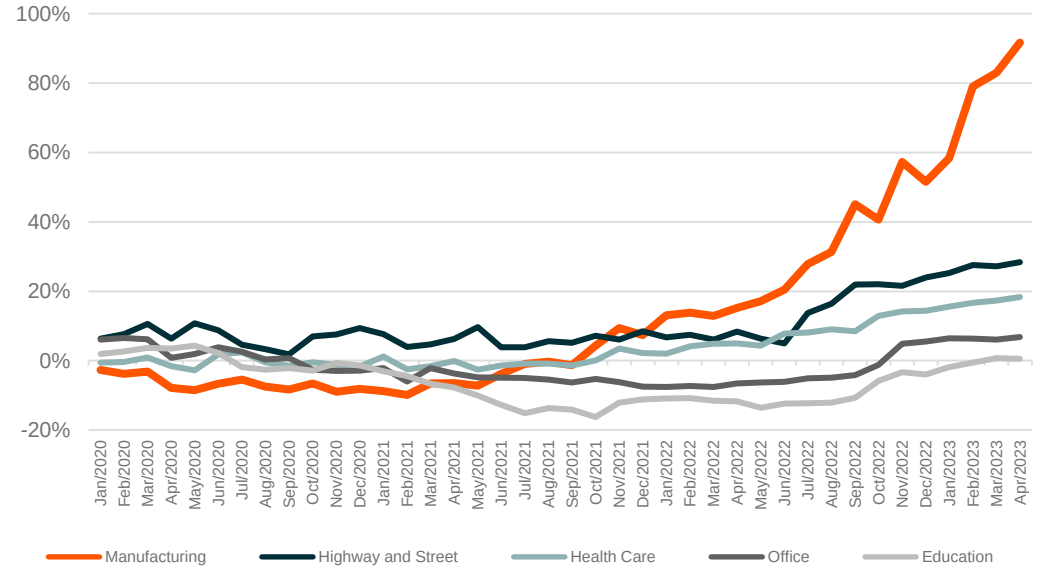
PREVALENCE OF SUPPLY CHAIN REORIENTATION BUZZWORDS IN NEWS STORIES (#, STORIES)



Note: Includes social media stories

U.S. spending on manufacturing capacity is high relative to history and outpaced growth in other segments in recent quarters. U.S. construction spending on manufacturing reached a record $108 billion in 2022.[2]

INCREASE IN U.S. CONSTRUCTION SPENDING BY CATEGORY SINCE JANUARY 2020 (CUMULATIVE, %)



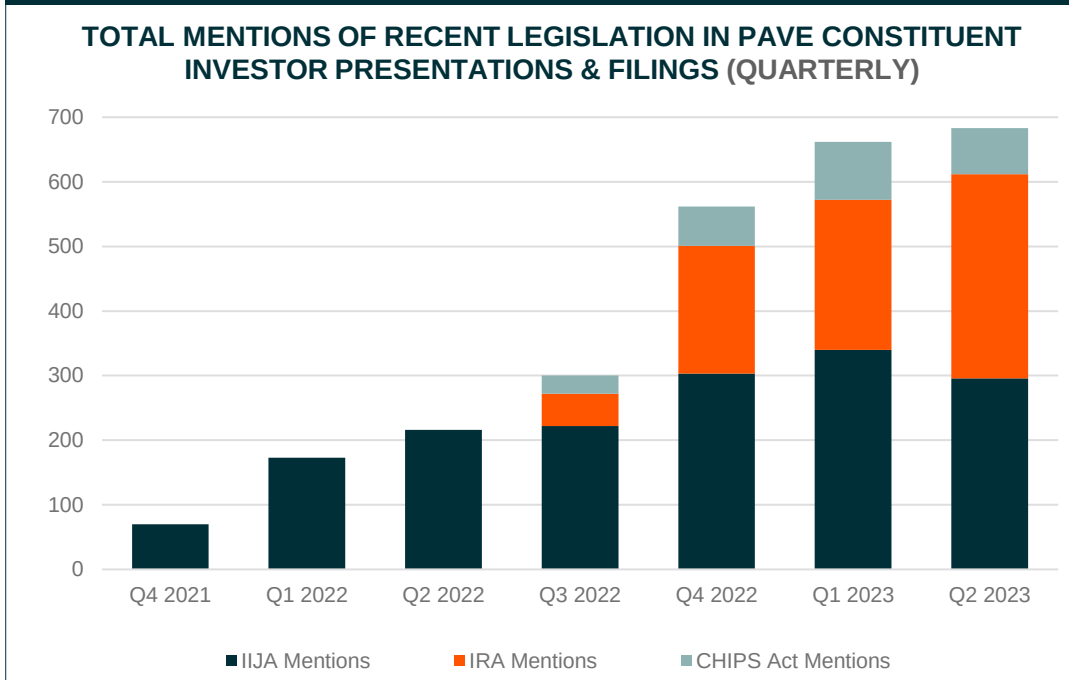
Source: U.S. Census Bureau

Source: Text: 1. Bossche, Ehrig, Troncoso, & Luo, 2022; 2. WSJ, 2023; Visual (LHS): Bloomberg, L.P., n.d.; Visual (RHS): U.S. Census Bureau, 2023

Inflation Reduction Act and CHIPS Act Add Momentum to Onshoring Trend

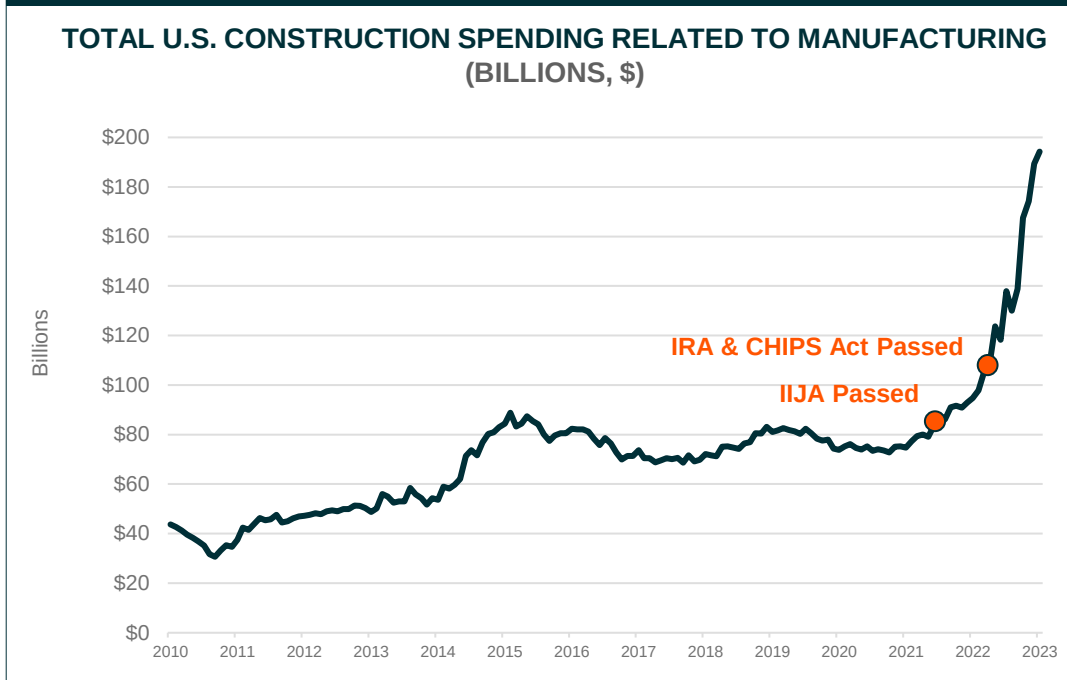
The Inflation Reduction Act (IRA) and CHIPS Act are designed to bolster U.S. competitiveness in disruptive technologies such as renewable energy, batteries, and electric vehicles (EVs), as well as semiconductors. Both packages are likely to encourage build-out of domestic supply chain assets.

Guidance from U.S. infrastructure companies continues to point to late 2023 for when the benefits from the IIJA, IRA, and CHIPS Act are likely to begin in earnest. Mentions of these bills have steadily increased over time.



Source: FactSet

Construction spending on manufacturing has accelerated since passage of the IRA and CHIPS Act in August 2022. Due in part to these bills, 2023 is likely to represent another record year for manufacturing construction.



Source: U.S. Census Bureau

Source: Visual (LHS): FactSet, 2023 (RHS): U.S. Census Bureau, 2023

U.S. Infrastructure: Just How Bad is it Really?

America's outdated infrastructure is in dire need of a 21st century overhaul – a C- grade from the American Society of Civil Engineers says as much. Deteriorating roads, waterways, & seaports are liabilities to the country's economic future.

SEGMENT	CURRENT STATE	ECONOMIC/SOCIAL IMPACT
Roads & Bridges	• 43% of roads were in poor or mediocre condition as of 2019[1] • 7.5% of US bridges were structurally unsound as of 2019[1] • Roads and bridges have a $786B project backlog[1]	• Traffic delays cost $166B productivity/fuel (2017)[1] • Traffic fatalities increased 60% in 2019 vs. 2009[1] • Poor road condition cost drivers $130B a year in car repairs[1]
Water Utilities	• 9% of drinking water systems serve 80% of US population[1] • 6B gallons of drinking water are lost to leaky pipes daily[1] • Up to 22M Americans drink water delivered by lead pipes[2] • 20% of US households are not connected to public sewers[1]	• $7.6B in drinking water was lost to leaks in 2019[1] • 63M people exposed to unsafe drinking water in the US[3] • 500,000+ U.S. children have elevated lead levels[4]
Electric Utilities	• 70% of US transmission lines are at least 25 years old[1] • 60% of circuit breakers are at least 30 years old[5] • 6% of electricity providers serve 72% of US customers[1]	• 2018's 'Camp Fire,' was partially caused by faulty power lines and caused $16.5B in damages[6] • Power outages cost the U.S. $28B - $169B, annually[1] • Distribution infrastructure issues cause 92% of outages[1]
Rail & Public Transit	• US passengers took 32.5M trips on Amtrak in 2019, 18.8M of which were in the Northeast Corridor (NEC)[1] • The avg. age of major NEC backlog projects is ~110 years old[7] • 45% of Americans have no access to transit[1]	• 73% of Amtrak trains were on time in 2018[8] • Amtrak's 2018 operating losses were $171M, partially due to delays[9] • Public transit delays could cost riders $1.2B over the next 10 years[10]

43% of roads were in poor or mediocre condition in 2019

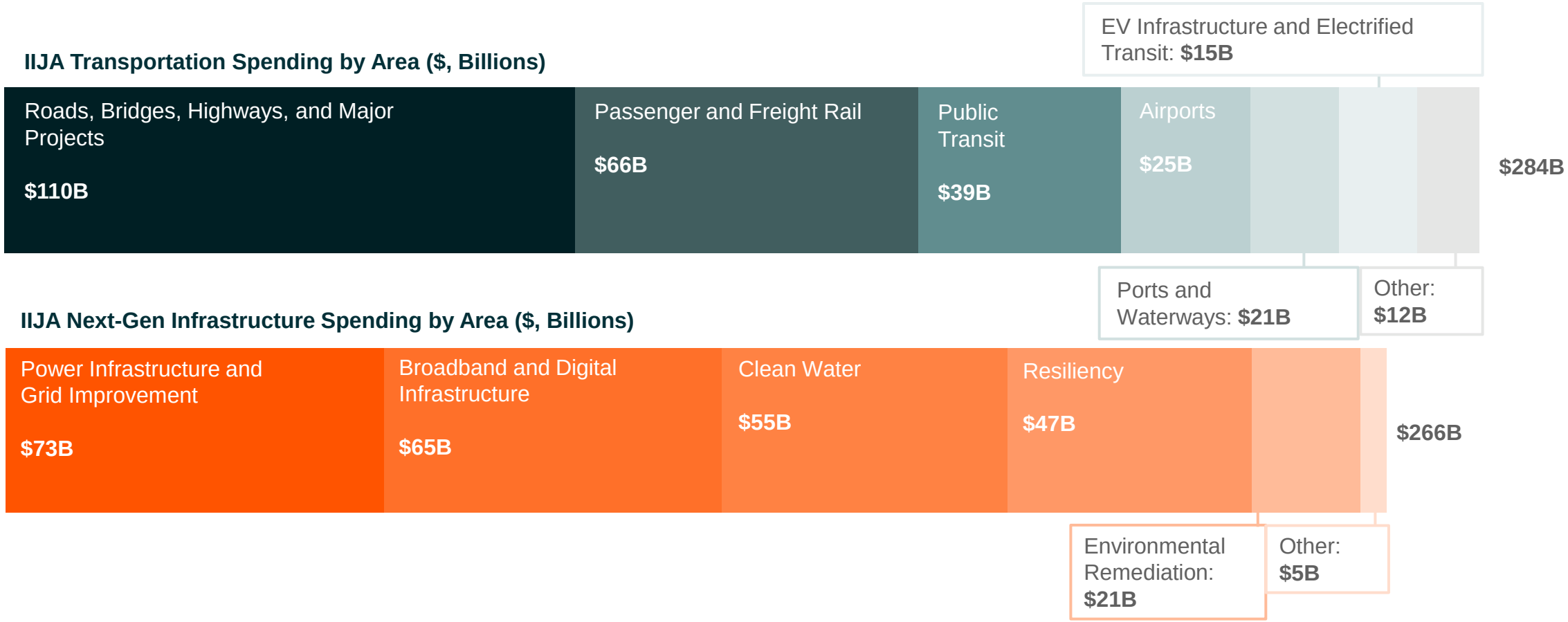
9% of drinking water systems serve 80% of the population

70% of transmission lines are at least 25 years old

Source: ASCE, "2021 Report Card for America's Infrastructure," March 2021.; 2. APM Reports, "Buried Lead How the EPA has left Americans exposed to lead in drinking water," May 2020.; 3. USA Today, "63 million Americans exposed to unsafe drinking water," August 2017.; 4. American Family Physician, "Lead Poisoning in Children," July 2019.; 5. EIA, "Major utilities continue to increase spending on U.S. electric distribution systems," July 2018.; 6. USA Today, "USA had world's 3 costliest natural disasters in 2018, and Camp Fire was the worst," January 2019.; 7. ASCE, "2017 Infrastructure Report Card: Rail," January 2017.; 8. Amtrak, "Train Operations," Oct. 2019.; 9. WSJ, "Amtrak, Seeking to Break Even, Sees Some Light at the End of the Tunnel," November 2019.; 10. ASCE, "Transit," March 2021.

U.S. Infrastructure: From Wishlist to Reality, The Infrastructure Investment and Jobs Act (IIJA)[1]

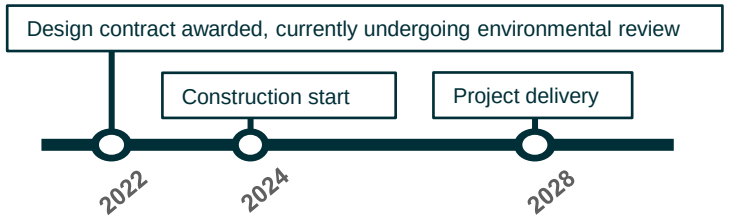
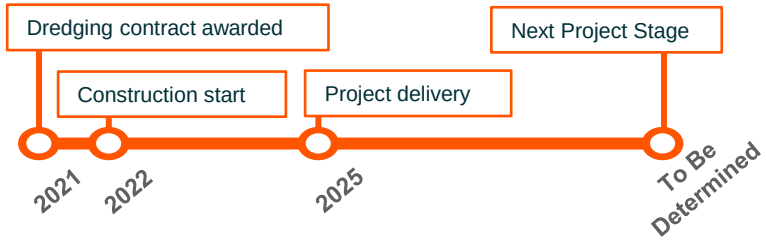
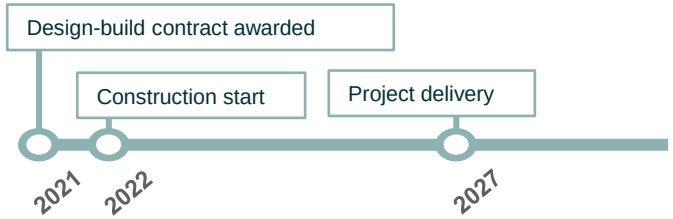
President Biden signed the bipartisan IIJA into law on November 15th, 2021. The $1.2 trillion package includes $550 billion of spending across a wide range of 21st-century infrastructure areas that could transform the United States.



Sources: 1. DeFazio, 2021

U.S. Infrastructure: IIJA-Funded Project Highlights

IIJA funding is already making a difference at the preexisting project level. Some long-stalled projects are moving forward, while others could use IIJA funds to advance on schedule. Major construction starts are expected to accelerate toward 2025.

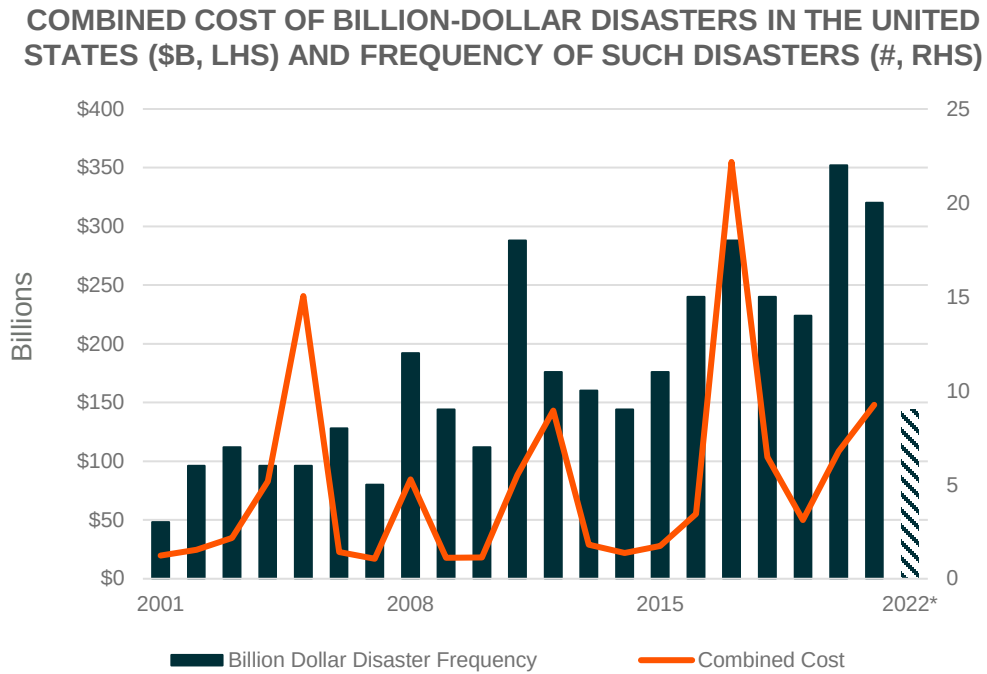
Project Description	IIJA Funding	Companies Involved[5]*	Project Timeline[5]
Denver International Airport Expansion (CO): Construction of a new seventh runway at the Denver International Airport that could cost $1.2B[1]	$59M allocated to Denver International Airport projects in FY 2022[2]	**Jacobs Engineering** (Design Consulting) **AECOM** (Project Management)	
Houston Ship Channel Project 11 (TX): $1B project to widen and deepen a segment of the Houston Ship Channel due to increasing volumes[3]	$142M provided by the Army Corps of Engineers to keep project on schedule[3]	**AECOM – Gahagan & Bryant Associates** (Planning) **Great Lakes Dredge & Dock Corp** (Dredging)	
Penn Station Access (NY): Connection of Metro-North Railroad to Penn Station in Manhattan that is expected to cost $2.9B[4]	$500M tapped from Amtrak's federal funding[4]	**Jacobs Engineering** (Prime Designer) **Halmar International** (Design Builder) *List of companies is not exhaustive.	

Sources: 1. Murray, 2021; 2. Federal Aviation Administration, n.d.; 3. Leggate, 2022; 4. McGeehan, 2021; 5. Fitch Solutions, n.d.

U.S. Infrastructure: Adapting to Climate Change With Resilient Infrastructure

Mother nature appears to be harsher than ever, with natural disasters occurring at unprecedented rates. U.S. infrastructure must be built or modified to withstand these events and other climate change-related impacts.

Damages from natural disasters could trend upward if the effects of climate change continue to intensify.



**Data as of first half of 2022*
Source: NOAA National Centers for Environmental Information (NCEI)

Population Centers

Rising sea levels could displace 13 million people in the United States by 2100.[1]

Transportation Infrastructure

The Pacific Northwest's 2021 wildfires caused thousands of miles of freight train reroutes.[2]

Water Infrastructure

In 2021, Hurricane Ida disrupted access to clean water for over 2 million people in Louisiana and Pennsylvania.[3,4]

Energy Infrastructure

Drought in the western U.S. threatens power for tens of millions as reservoirs approach water levels unusable for hydroelectric generation.[5]

PROTECT Formula Program: Promoting Resilient Operations for Transformative, Efficient, And Cost-Saving Transportation[6]

The IIJA allocates $8.7 billion toward the PROTECT Formula Program to defend transportation infrastructure against rising sea levels, flooding, extreme weather events, and other natural disasters. States can access funding for these eligible activities:

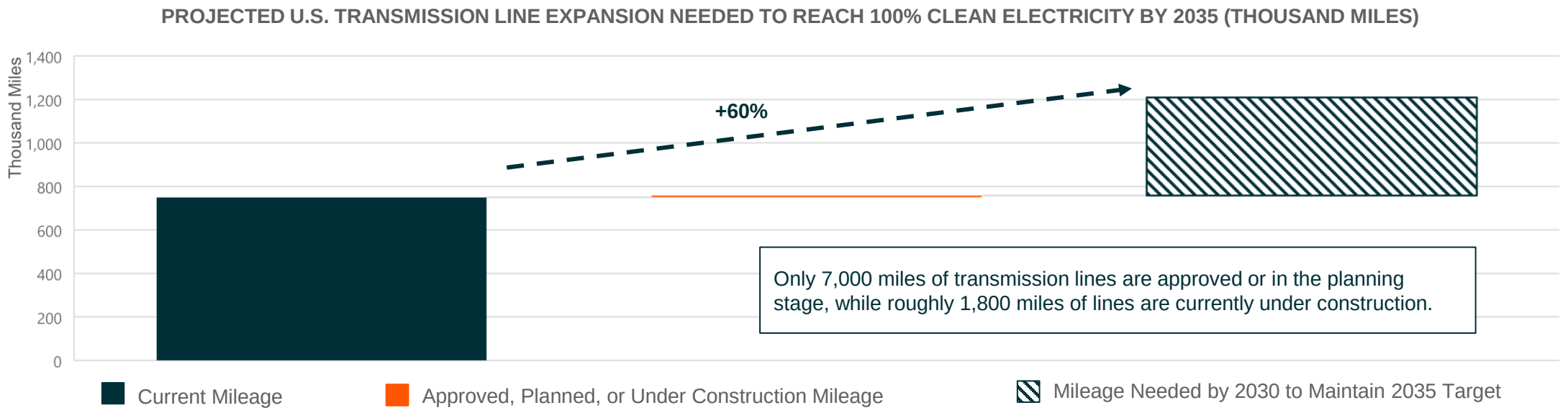
- Planning: Design/development of tools to simulate transportation disruption scenarios, boost state capacity to increase responsiveness, and evacuation planning/preparation.
- Resilience Improvements: Modifications to existing transportation assets to withstand one or more elements of climate change, such as flood or wildfire.
- At-Risk Coastal Infrastructure: Enhancements/relocation of highway, bridge, road, pedestrian walkway, and bicycle lane assets to bolster infrastructure that is disproportionately susceptible to coastal impacts of climate change.

Sources: Text: 1. University of Southern California, 2020; 2. Gormley, 2021; 3. Maykuth, 2021; 4. Rubiano, 2021; 5. UN News, 2022; 6. Federal Highway Administration, 2021; Visual: National Centers for Environmental Information, 2022

U.S. Infrastructure: Grid Modernisation Needs Heavily Outweigh Project Pipeline

A well-connected grid is key to accommodating higher levels of renewable energy generation. Transmission lines, especially high-voltage variants, give operators flexibility to transport electricity throughout the grid when renewable output fluctuates. Recent policy shifts could help boost the transmission project pipeline.

The Department of Energy suggests that electricity transmission capacity must expand 60% by 2030 to accommodate a U.S. goal of reaching 100% clean electricity by 2035.[1] Currently, the transmission line project pipeline is limited. Only 5,000 miles are on track for delivery by 2025.[2]



Note: Mileage needed based on Department of Energy Guidance

Average voltage for transmission pipeline is 375 kilovolts (kV).[3] Voltage exceeding 500kV is preferred for high-power voltage lines in a renewably powered grid.[4]

Sources: Text: 1. U.S. Department of Energy, 2022; 2. American Clean Power, 2022; 3. Fitch Solutions, n.d.; 4. EMF Portal, n.d.; Visual (LHS): GeoPlatform ArcGIS Online, n.d.; Fitch Solutions, n.d.; U.S. Department of Energy, 2022; Visual (RHS): Edison Electric Institute, 2022

GLOBAL X

by Mirae Asset

Global X U.S. Infrastructure Development UCITS ETF (PAVE LN)

Global X U.S. Infrastructure Development UCITS ETF (PAVE LN)

PAVE LN seeks to provide investment results that correspond generally to the total return of the Indxx U.S. Infrastructure Development v2 Index before fees and expenses.

Compelling Need
The American Society of Civil Engineers assigned a letter grade of C- to the state of U.S. infrastructure in its 2021 report card, highlighting the need for investment.[1]

Multiple Catalysts
In addition to the prospect of federal stimulus, infrastructure investments may be catalysed by state, local and public-private partnerships on an ongoing basis.

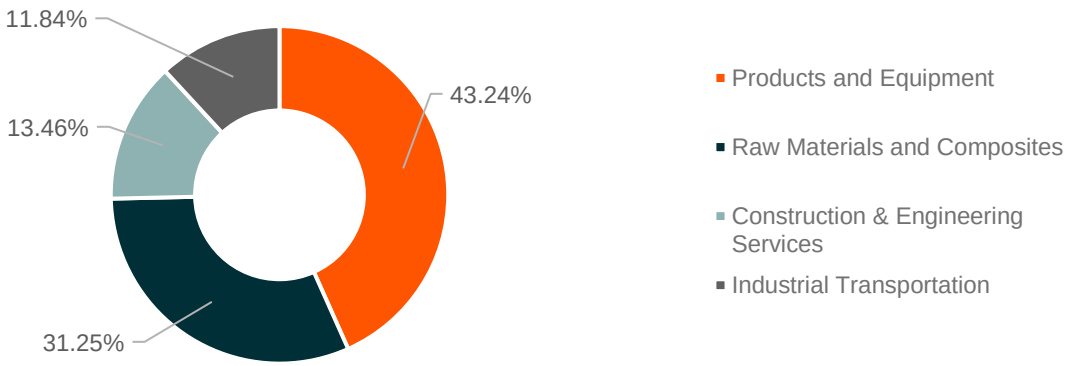
Unconstrained Approach
As the economy evolves, so do infrastructure needs. The ETF seeks to capture this trend by investing in companies that are part of the infrastructure theme, regardless of sector or industry classification.

Key Facts[2]

Inception Date:	November 02, 2021	**AUM:**	$181,862,315.00
Index:	Indxx U.S. Infrastructure Development v2 Index	**Index Ticker:**	IPAVEN2
Total Expense Ratio:	0.47%	**Ongoing Charges:**	0.47%
Primary ISIN:	IE00BLCHJ534	**Domicile:**	Ireland
Registered Countries:	Austria, Denmark, Finland, Germany, Ireland, Italy, Netherlands, Norway, Singapore [Restricted], Spain, Sweden, Switzerland, United Kingdom	**Listing Exchanges:**	London Stock Exchange, Deutsche Börse Xetra, Borsa Italiana, SIX Swiss Exchange, Bolsa Mexicana De Valores
		SFDR Classification	Article 6
Number of Holdings:	99	**Management Style:**	Physical - Full Replication – Passively Managed

Key Characteristics[3]

Thematic Segment Breakdown



Top 10 Holdings

Name	Weight %
Eaton Corp PLC	3.41%
Parker Hannifin Corp	3.37%
Fastenal Co	3.24%
Rockwell Automation Inc	3.21%
United Rentals Inc	3.07%
Trane Technologies PLC Class A	3.00%
Vulcan Materials Co	2.90%
CSX Corp	2.86%
Nucor Corp	2.86%
Martin Marietta Materials Inc	2.75%

Sources: 1. American Society of Engineers, Mar 2021.; 2. Morningstar Direct, Global X ETFs, as of 30/06/2023., 3. Ibid.

Global X U.S. Infrastructure Development UCITS ETF (PAVE LN)

The Global X U.S. Infrastructure Development UCITS ETF (PAVE LN) seeks to invest in companies that stand to benefit from a potential increase in infrastructure activity in the United States, including those involved in the production of raw materials, heavy equipment, engineering, and construction.

Underlying Index Selection Process

1 Initial Universe

- Primary listing on U.S. exchanges
- Market Cap ≥ $300 million
- 6-Month ADTV ≥ $1 million

2 Sub-Theme Revenue Criteria

- Index provider narrows universe to companies that generate ≥ 50% of revenues from **infrastructure development-related** sub-themes & ≥ 50% of revenues from the U.S.

3 Final Composition

- Top 100 pure-play companies by market cap

4 Annual Rebalance/Reconstitution

- Index components are weighted according to modified market cap-weighting approach:
  - Max weight = 3.0%
  - Floor = 0.3%

PAVE LN Sub-Themes

CONSTRUCTION & ENGINEERING SERVICES

Companies that provide engineering, design, maintenance and construction services for large-scale infrastructure projects such as energy generation/distribution, water/wastewater, telecommunications, transportation (roads, bridges, tunnels, rail), airports and seaports.

RAW MATERIALS & COMPOSITES

Companies that produce and supply raw and composite materials (steel, copper, nickel, tin, aluminum, concrete, asphalt, cement and specialty chemicals) that are utilized in the construction and development of infrastructure projects.

PRODUCTS & EQUIPMENT

Companies that sell or rent heavy construction equipment, cranes, electric and fiber optic cables, pipes, pumps, smart meters and other products or equipment utilized in large-scale infrastructure projects.

INDUSTRIAL TRANSPORTATION

Companies that transport infrastructure raw materials and equipment.

Full Index Methodology: Indxx U.S. Infrastructure Development v2 Index

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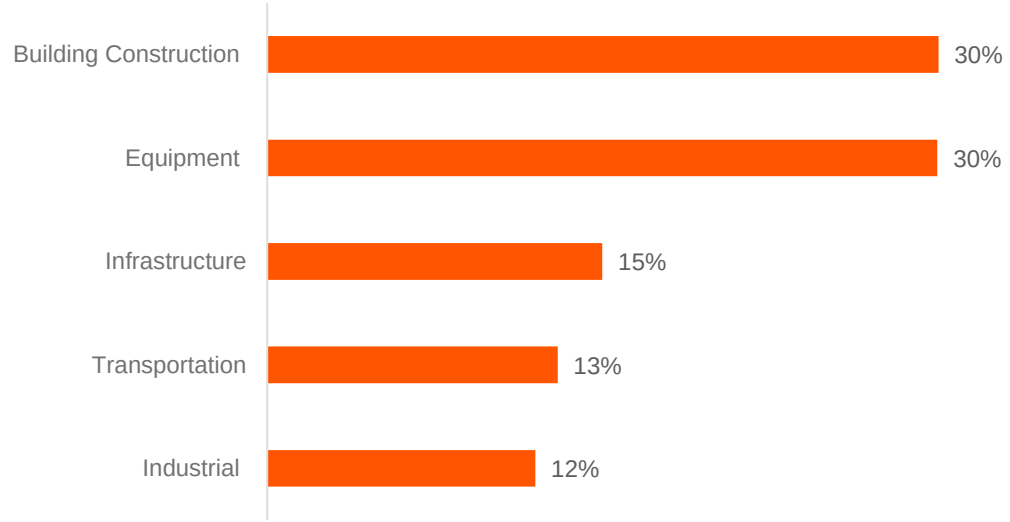
Market Outlook: Copper

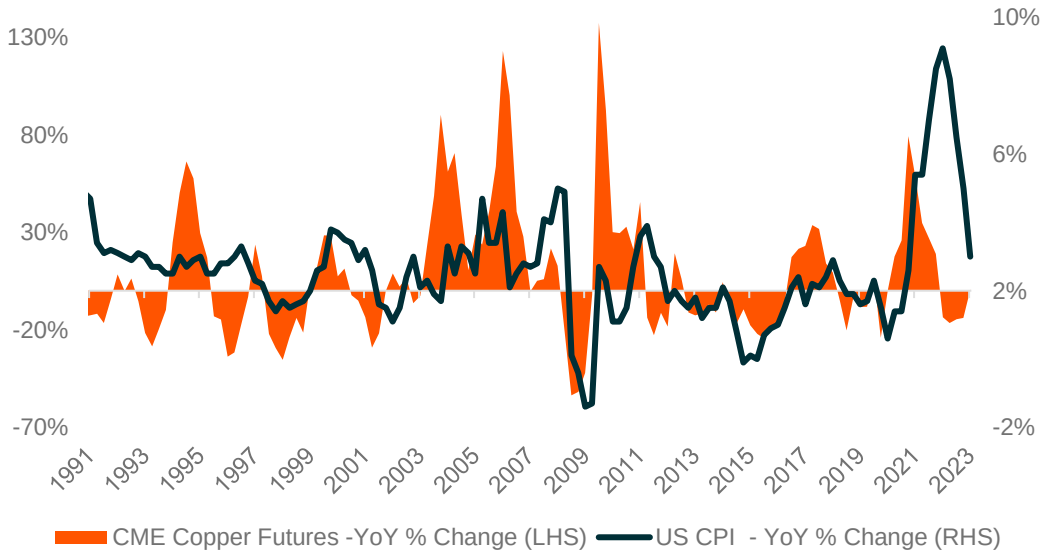
Copper's credentials come from its wide use in the global economy. Unlike other metal commodities, copper is used in many products, its price increases can be passed down into final consumer products, which will then undergo inflationary pressures. As copper is used across the economy, these pressures can be felt in every sector, once again leading to consumer price rises. Copper futures, a popular way to get exposure to the commodity, tend to rise before general consumer prices rise, thus can be bought as a proactive **potential inflation hedge**.

Copper End Use



Sources: Global X ETFs with information derived from Bloomberg Intelligence as of June 2023.

Inflation Can Have an Impact on Copper Futures Prices

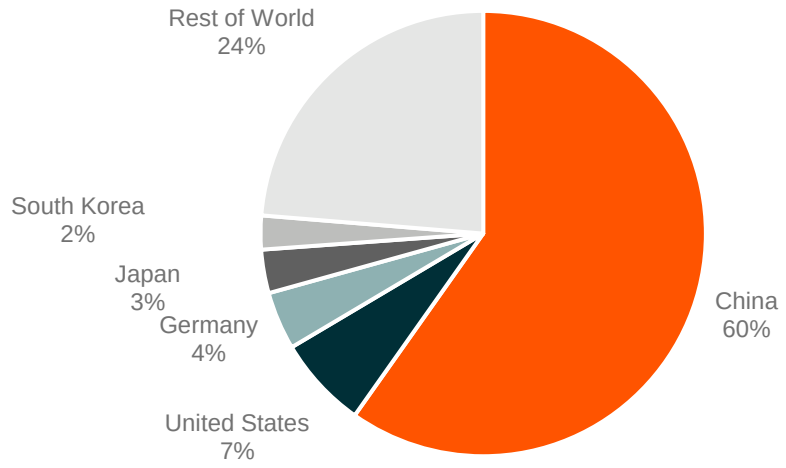


Sources: Global X ETFs with information derived from Bloomberg LP. Data from June 30, 1991 to June 30, 2023

Copper: China as the Key Driver of Demand and Refined Production

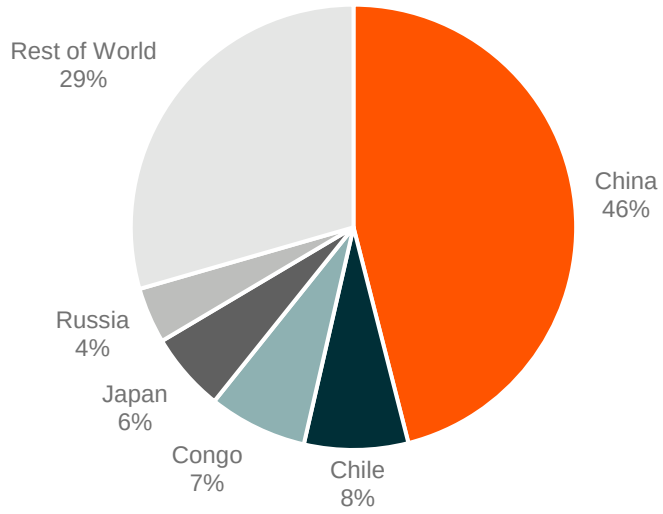
China is a key driver as the world's largest consumer of copper, accounting for more than half of the total demand. China's economic development has triplicated its copper demand in the last decades. Despite China dominating refined copper production, China is typically net short copper as it consumes more than it produces. Indeed, the early stages of industrialisation are very copper intensive as infrastructure, grid investment, and construction drive economic growth.

Copper Demand Share
Percent



Sources: Global X ETFs with information derived from Bloomberg LP. Data as of May 31,2023

Copper Refined Production Share
Percent



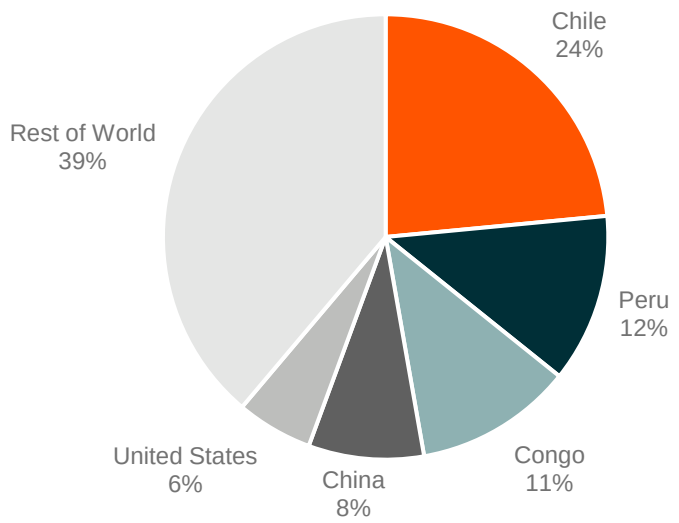
Sources: Global X ETFs with information derived from Bloomberg LP. Data as of May 31,2023

Copper: Chile as the Main Player in Mine Production & Reserves

- In the past few decades, South America has emerged as the key region in terms of copper mine production. (**Chile and Peru alone most of the global copper supply)**. Chile, Peru and Australia have the most copper deposits. Reserves refer to the minerals base that is economically mineable, but its extraction has not started yet. Typically, reserves grow as demand grows up to the point of geological limitations.

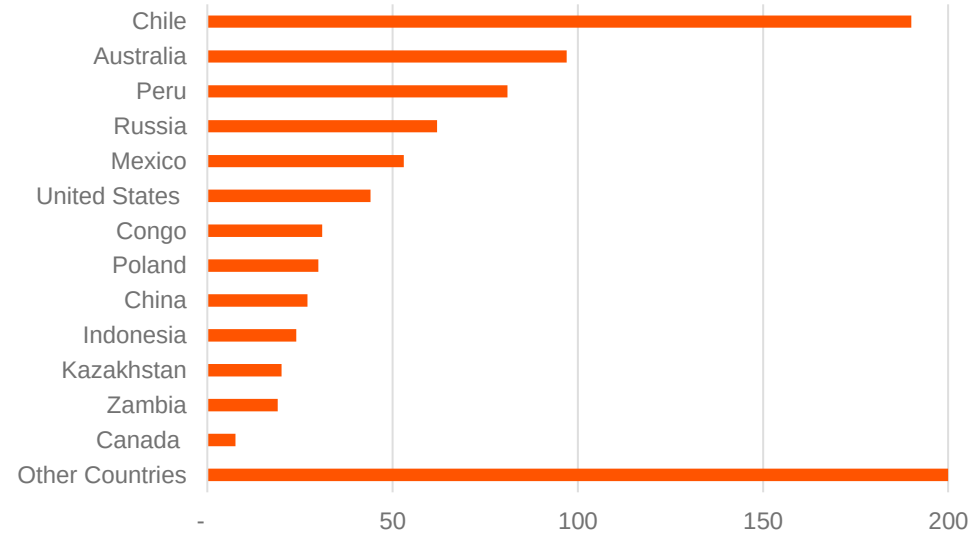
- Although supplies are plentiful, disruptions sometimes arise due to labour strikes, grade issues or natural disasters, for example, pit wall slides. Due to its importance in construction and power transmission, **the economic impact of any copper supply disruption can be high and support copper prices.** As these disruptions can impact local mine profits, these disruptions can have a positive impact on non-local mining operations as global supply slows.

Copper Mine Production Share
Percent



Sources: Global X ETFs with information derived from Bloomberg LP. Data as of May 31,2023

Copper Reserves
Million metric tonnes



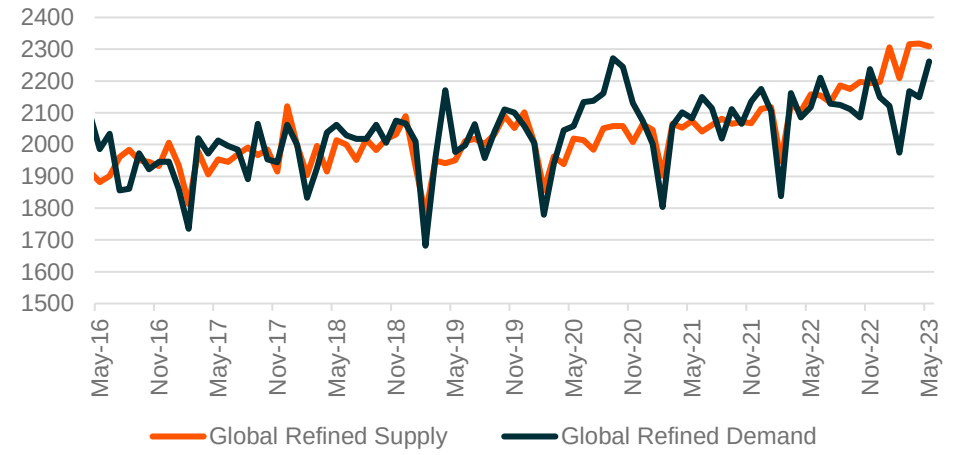
Sources: U.S. Geological Surveys, January 2023.

Copper Market Balance

- Considering the time and resources needed for the discovery and infrastructure buildout of new mines, **long lead times result in a timing mismatch between a pickup in demand and the consequent response in supply**, **accentuating the price dynamics**. The development stage of new copper mining capacity typically takes 4-12+ years, with brownfield projects on the quicker end of the spectrum and new greenfield projects taking significantly longer. Lead times can be considerably longer in countries where permitting is more complex.

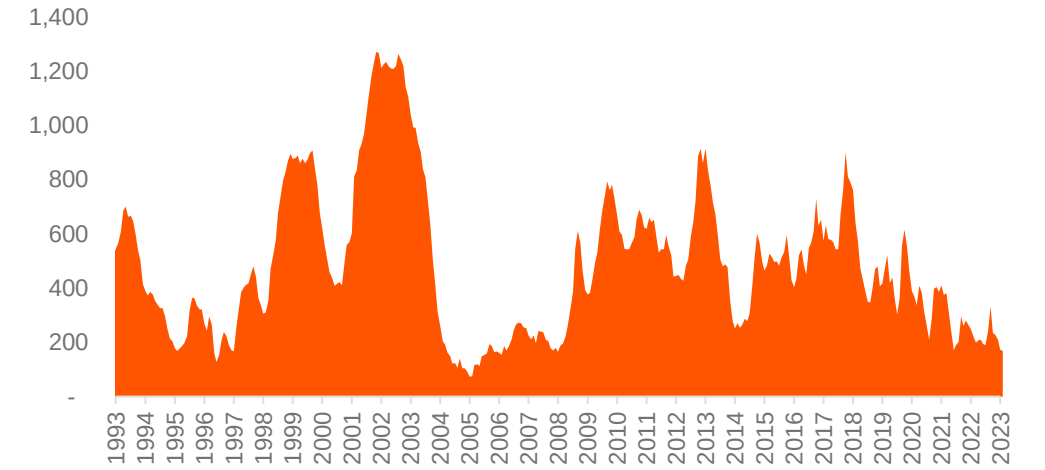
- Exchange inventories reflect stockpiles that are tracked via COMEX[1], LME [2] and SHFE[3] exchanges. They are not necessarily a representation of the entire universe. However, they provide a valid proxy, closely watched by the markets. Exchange stocks falling to critically low levels can contribute to higher copper prices.

Copper Supply/Demand (Kmt)



Sources: Global X ETFs with information derived from Bloomberg LP. Data from May 2016 to May 2023.

Exchange Copper Inventories (Kmt)



Sources: Global X ETFs with information derived from Bloomberg LP. Data from June 30, 1993, to June 30, 2023.

1. COMEX (The Commodity Exchange Inc.) is a Designated Contract Market (DCM) for CME Group, offering benchmark metals products.2. LME (The London Metal Exchange) is a futures and forwards exchange with the world's largest market in standardized forward contracts, futures contracts and options on base metals. 3. SHFE (The Shanghai Futures Exchange) was formed from the amalgamation of the national level futures exchanges of China, the Shanghai Metal Exchange, Shanghai Foodstuffs Commodity Exchange, and the Shanghai Commodity Exchange in December 1999.

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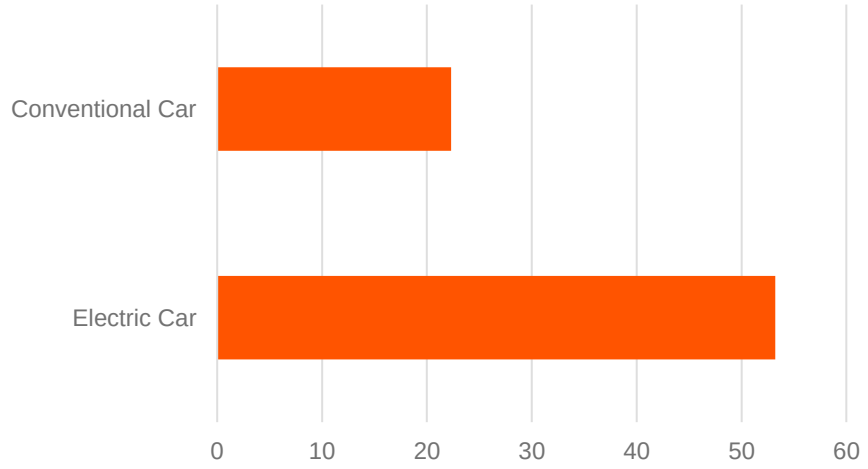
Copper: Decarbonisation

Copper is considered one of the core material building blocks for **clean energy technologies** because it has the highest conductivity of all non-precious metals. Copper's key characteristics—conductivity, ductility, efficiency, and recyclability—make copper omnipresent in renewables, from solar panels and EV batteries to thermal energy and wind turbines. Not only is copper used within vehicle production but is also considered a vital commodity for various aspects of EV infrastructure, giving copper a strong growth tilt.

Beyond EVs and charging infrastructure, renewable energy sources like solar panels and offshore wind turbines require a relevant quantity of copper.

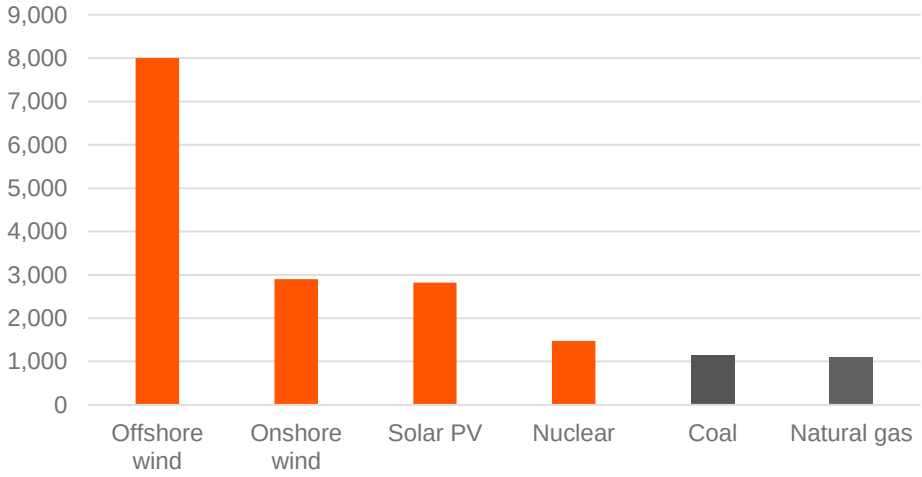
1. **Solar Power**: PV solar systems require a heavier amount of copper compared to traditional energy systems.
2. **Wind Farms**: In a wind farm, copper is used for generators, wiring, cable and step-up transformers.
3. **Electric Grid**: The surrounding infrastructure that connects these technologies to the electrical grid also uses copper to run reliably and efficiently.

Copper usage in EVs vs. ICE VEHICLES (kg/vehicle)



Sources: International Energy Agency, 2022. Minerals used in electric cars compared to conventional cars.

Copper usage in clean energy technologies compared to other power generation sources(kg/MW)



Sources: International Energy Agency, 2022. Minerals used in clean energy technologies compared to other power generation sources.

GLOBAL X
by Mirae Asset

Global X Copper Miners UCITS ETF (COPX LN)

Global X Copper Miners UCITS ETF (COPX LN)

COPX LN seeks to provide investment results that correspond generally to the total return of the Solactive Global Copper Miners v2 Index before fees and expenses.

Targeted Play
COPX LN is a targeted play on copper mining.

Appeal of Copper
Copper is an essential input in electric vehicles, renewable energy storage, and other forms of next-generation infrastructure that we expect to gain popularity.

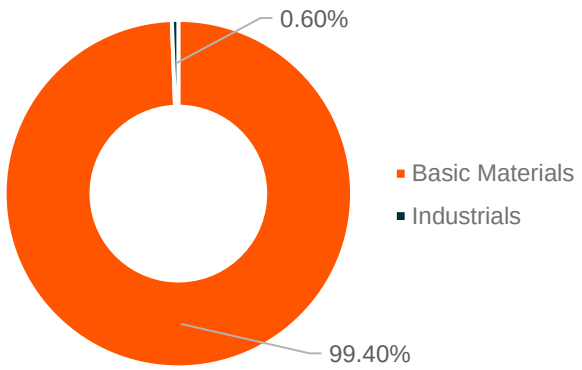
ETF Efficiency
In a single trade, COPX LN could deliver efficient access to a basket of companies involved in the mining of copper.

Key Facts[1]

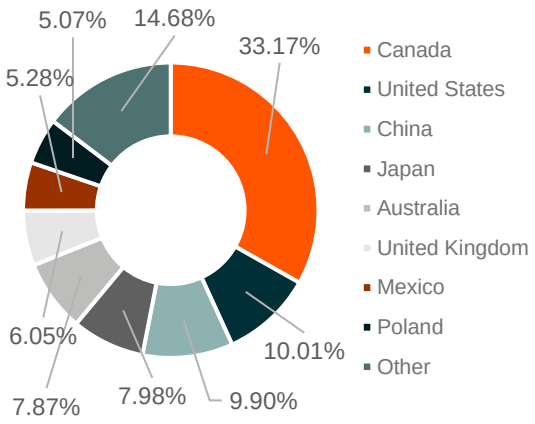
Inception Date:	November 22, 2021	**AUM[1]:**	$56,109,144.00
Index:	Solactive Global Copper Miners v2 Index	**Index Ticker:**	SOLGLOCM
Total Expense Ratio:	0.55%	**Ongoing Charges:**	0.55%
Primary ISIN:	IE0003Z9E2Y3	**Domicile:**	Ireland
Registered Countries:	Austria, Denmark, Finland, Germany, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom	**Listing Exchanges:**	London Stock Exchange, Deutsche Börse Xetra, Borsa Italiana, SIX Swiss Exchange, Bolsa Mexicana De Valores
		SFDR Classification	Article 6
Number of Holdings:	38	**Management Style:**	Physical - Full Replication – Passively Managed

Key Characteristics[2]

Sector Breakdown



Country Breakdown[3]



Top 10 Holdings

Name	Weight %
Ivanhoe Mines Ltd Class A	5.52%
Lundin Mining Corp	5.51%
BHP Group Ltd	5.35%
Grupo Mexico SAB de CV	5.28%
Freeport-McMoRan Inc	5.10%
KGHM Polska Miedz SA	5.07%
Teck Resources Ltd Class B (Sub Voting)	5.07%
Glencore PLC	5.06%
Antofagasta PLC	5.05%
First Quantum Minerals Ltd	5.00%

1. Source: Morningstar Direct, as of 30/06/2023.; 2. Ibid.; 3. Other: Switzerland (5.1%), Sweden (4.0%), Germany (3.6%), Cyprus (0.6%), Turkey (0.5%), Hong Kong (0.3%).

Global X Copper Miners UCITS ETF (COPX LN)

Different ways to access Copper:

1 Physical Ownership

- Directly tracks spot prices in Copper

2 Options and Futures

- Closely tracks spot prices in Copper but can be susceptible to contango[1]

3 Copper Mining Companies

- Leveraged plays on Copper prices, owing to the high fixed costs of extracting the metal
- Indirect exposure to copper given that miners can have revenues from other metals

4 Copper Mining ETF

- Invests in a diverse basket of companies involved in Copper mining

Index Methodology – Solactive Global Copper Miners v2 Index

1 Security Selection Criteria

- Minimum AUM level of $200 million non-current constituents and at least $100 million if they are current constituents
- Average daily turnover of ≥ $500,000 over the last three months for non-current constituents, and $250,000 for current constituents.
- Average monthly trading volume of at least 75,000 shares in each of the last six months (“Liquidity Criterion”)

2 Security Selection Process

- The index seeks to include companies that have or are expected to have significant exposure to the copper mining industry, this includes constituents that have:
  1. 50 < of revenue derived from copper mining and/or closely related actives (e.g., exploration or refining of copper)
  2. A the constituent is expected to generate a significant part of its revenues in copper mining and/or closely related activities in the future
- The minimum number of constituents is 20 and the maximum number of constituents is 40.

3 Weighting Scheme

- Index components are weighted according to their free float market capitalization.
  - Each component has a max weight of 4.75%
  - The aggregate weight of companies that do not fulfil the Size Criteria cannot exceed 10% of the index weight.
  - The aggregate weight of the index components listed on a Russian stock exchange is capped at 15%.

4 Rebalance/Reviews

- The index follows a semi-annual reconstitution and rebalancing schedule. Rebalances are made on the last trading day of April and October
- Listing Standard Review: The index follows a quarterly continuous listing standard review, made on the last trading day of January, April, July, and October.

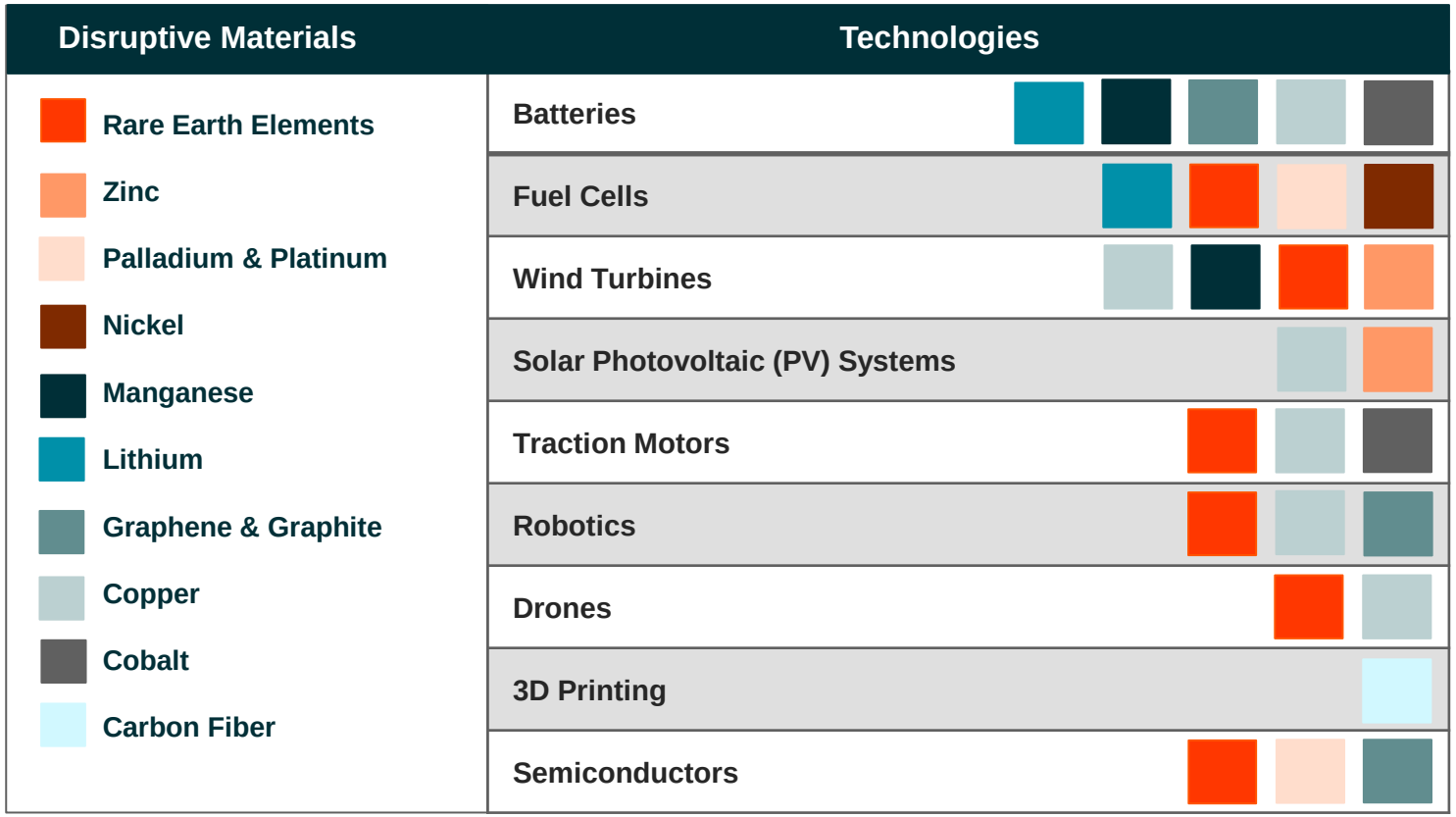
Full Index Methodology: Solactive Global Copper Miners v2 Index

Source: 1. Contango is when the spot price of a commodity trades below its future price.

Contents

Disruptive Materials: Essential to Emerging and Clean Technologies

Metals, minerals, and materials are the critical but often unheralded ingredients fueling the advancement of disruptive technologies that can help slow climate change, improve productivity, and connect people around the world.



Highlighted Disruptive Materials

- **Rare Earth Elements:**[1] Neodymium, praseodymium, terbium, and dysprosium are among the rare earth elements used to manufacture permanent magnets for wind turbines, traction motors, robotics, and drones.
- **Zinc:**[2] Among its use cases, zinc can be a coating to protect wind turbines and solar panels from rust. The metal can also be used in batteries and galvanized steel.
- **Graphene & Graphite:**[3,4] Often described as a wonder material, graphene is the thinnest known material but also the strongest, being 100x stronger than steel. End-use markets include auto and transportation, aerospace, and construction.
- **Copper:**[5] High conductivity and resistance to corrosion make copper a key component of renewable energy systems, including wind and solar power.

Sources: Text: 1. Patricia, Silvia, Samuel, & Beatrice, 2020; 2. Venditti, 2022; 3. Russell, 2019; 4. Pistilli, 2022; 5. Copper Development Association Inc., n.d.; Visuals: Global X ETFs with information on required materials derived from International Energy Agency, 2021

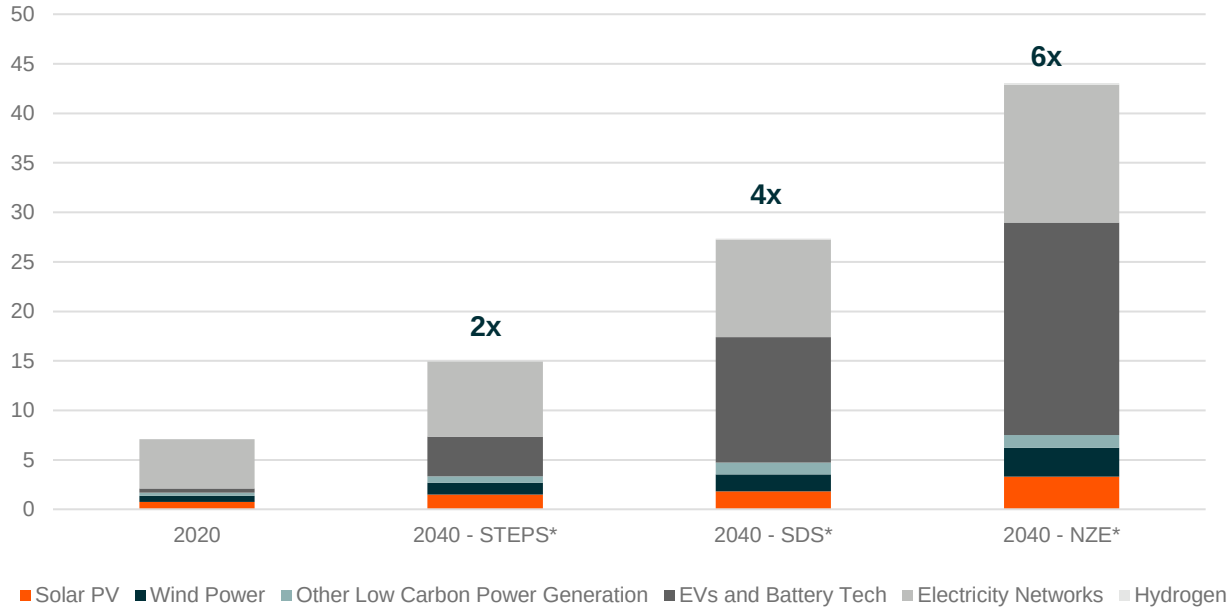
Clean Technologies Present Significant Potential Growth Opportunities for Disruptive Materials

Disruptive materials are critical to the decarbonisation of the power and transport sectors. The International Energy Agency's (IEA) climate change scenarios provide glimpses into potential demand for disruptive materials.

The IEA projects disruptive materials production to multiply by 2–6 times from 2020 levels over the coming decades.

CleanTech Related Disruptive Materials Demand by Policy Scenario (Mt)

- **Stated Policies Scenario (STEPS):** Takes a conservative approach to the implementation and achievement of existing climate change goals. It does not consider any significant measures beyond what policy makers had in place as of 2021.
- **Sustainable Development Scenario (SDS):** Assumes all current net-zero pledges are achieved in full, with the developed economies reaching net zero emissions by 2050, China around 2060, and every other country by 2070.
- **Net Zero Emissions By 2050 Scenario (NZE):** The best-case scenario in which net-zero emissions are reached by 2050, limiting the global temperature increase to 1.5°C.



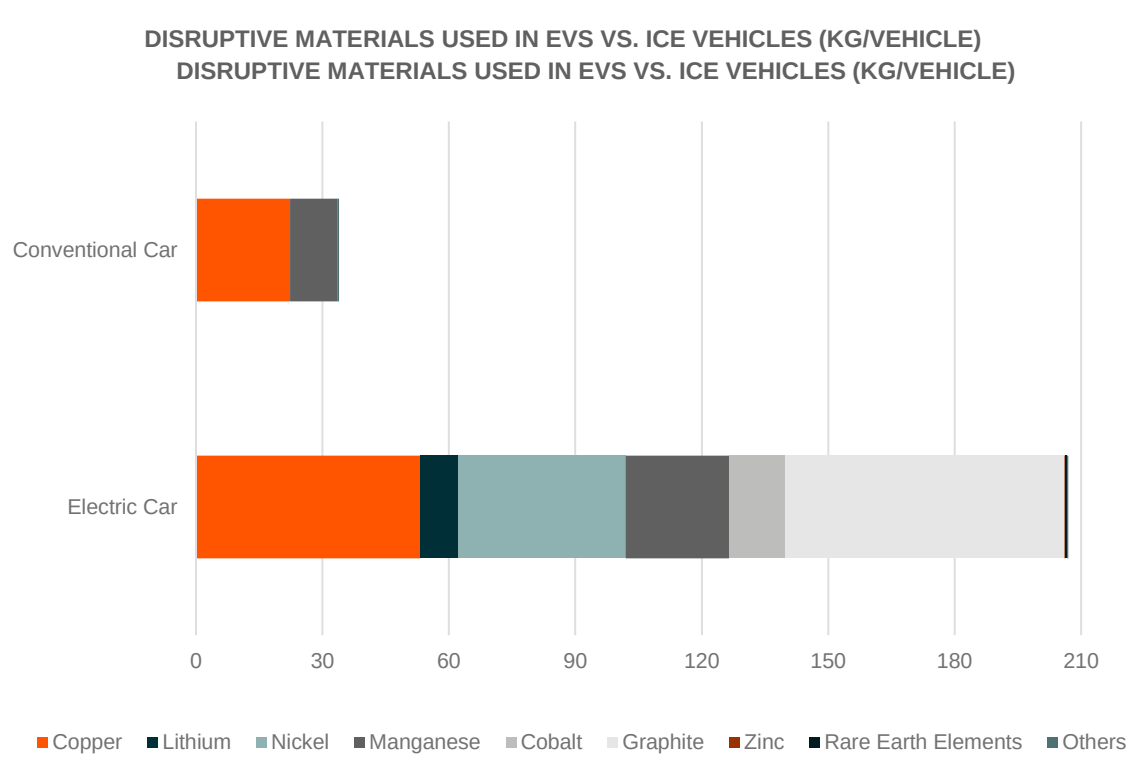
** Estimates*

Source: International Energy Agency, 2022

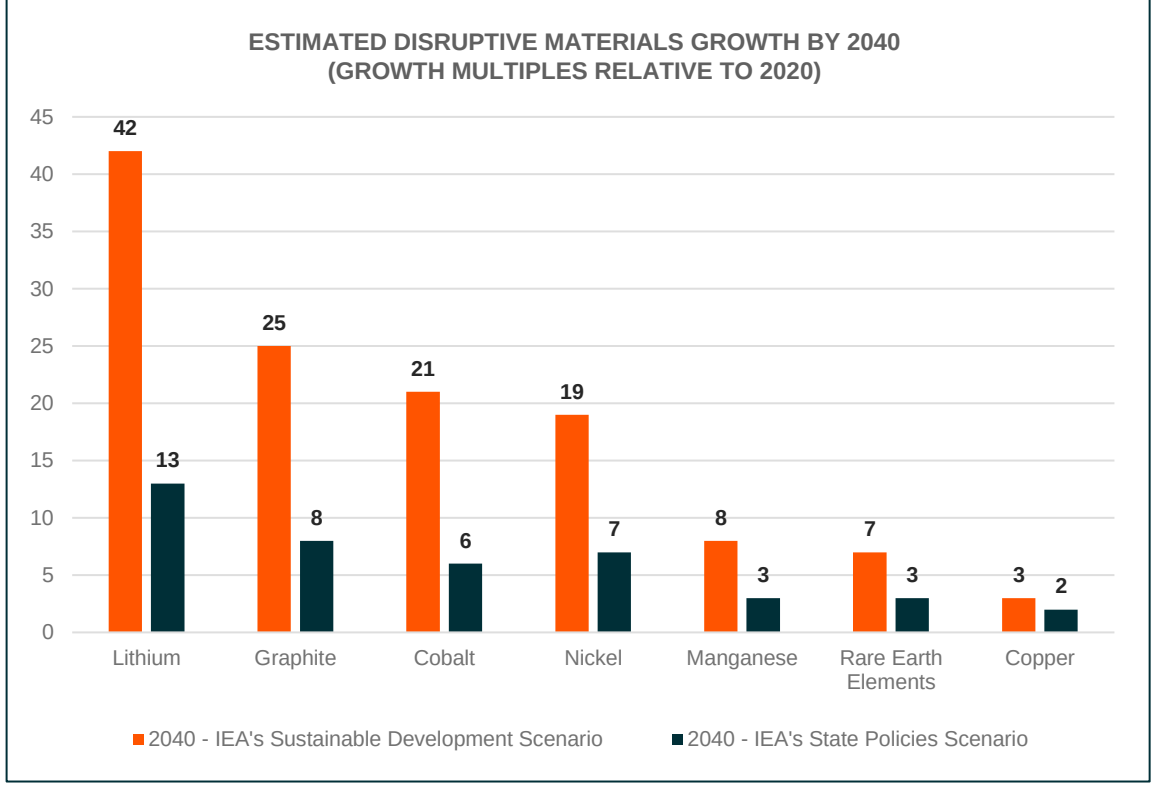
Disruptive Materials: Supercycle Potential

The emergence of cleantech and other emerging technologies could create unprecedented demand for certain metals and materials, potentially resulting in shortages and rising prices.

Lithium, graphite, copper, nickel, cobalt, and manganese are just a few of the disruptive materials EVs use.



Emerging and clean technologies could support years, if not decades, of strong demand for disruptive materials.

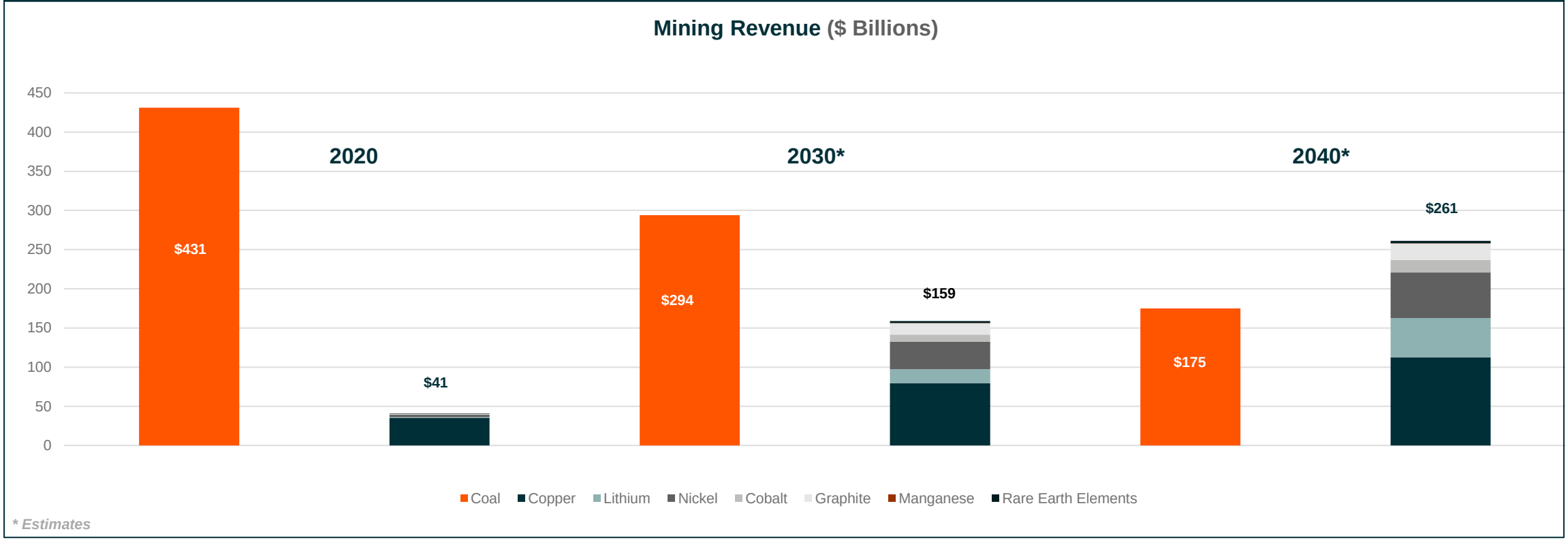


Source: (left and right-hand charts) International Energy Agency, 2022

Disruptive Materials In, Fossil Fuels Out

Disruptive materials are likely to replace fossil fuels as the key raw materials that run the 21st-century economy.

As companies move further into disruptive materials, we expect revenue profiles to shift significantly. According to one estimate, mining revenue from disruptive materials could increase fivefold to over $250 billion by 2040, while coal mining revenues decline by 59%.

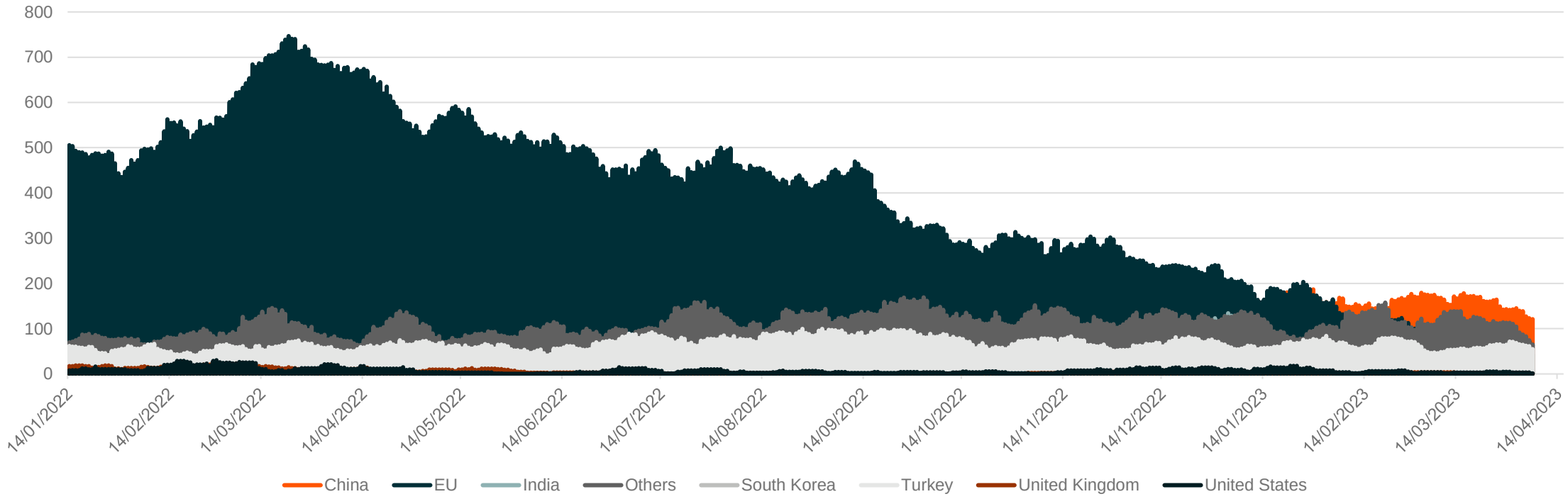


Source: International Energy Agency, 2022

Concerns Over Energy Security Creating Additional Tailwinds for Disruptive Materials

The EU is working to reduce dependence on imported fossil fuels, particularly those from Russia. Accelerating the clean energy transition can further boost potential opportunities for both clean technologies and the materials that are vital to their performance.

Daily Russian Fossil Fuel Flows, By Import Country (Million EUR)

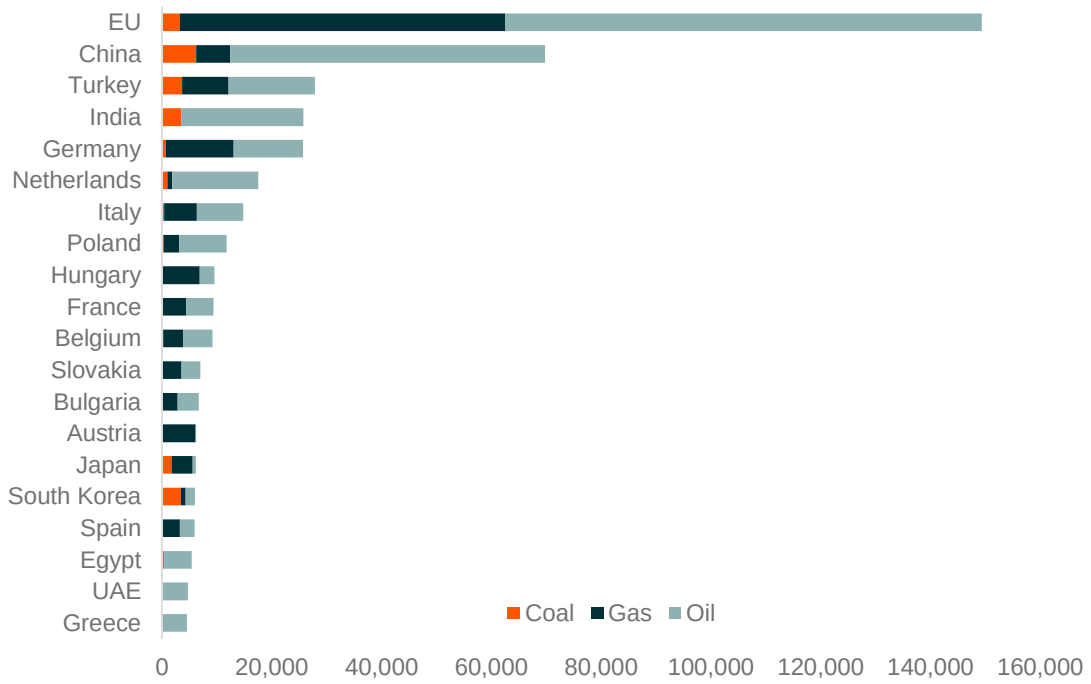


Source: CREA analysis, April 2023. Daily flows by geography. 14-day running average.

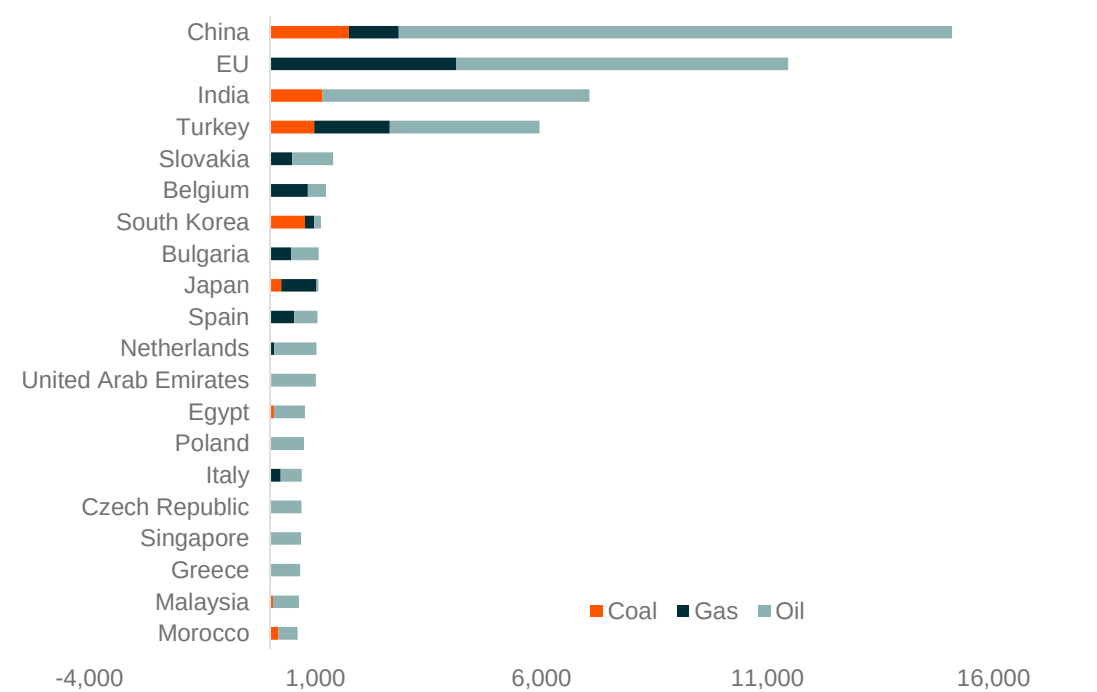
Concerns Over Energy Security Creating Additional Tailwinds for Disruptive Materials

Taking in consideration only 2023, China has become the largest importer of fossil fuels from Russia. While the EU has significantly reduced Russian fossil fuel imports, growth in clean technologies can help further reduce dependence.

Importers of Fossil Fuels From Russia (Million EUR)
From beginning of the war until 10 April 2023



Importers of Fossil Fuels From Russia (Million EUR)
From 1 January 2023 until 10 April 2023



Source: (left and right-hand charts) CREA analysis, April 2023. Largest importers of fossil fuels from Russia. From beginning of the war until 10 April 2023

GLOBAL X

by Mirae Asset

Global X Disruptive Materials UCITS ETF (DMAT LN)

Global X Disruptive Materials UCITS ETF (DMAT LN)

DMAT LN seeks to provide investment results that correspond generally to the total return of the Solactive Disruptive Materials V2 Index before fees and expenses.

High Growth Potential
Forecasts suggest the global rare earth elements (REE) market could more than double between 2020 and 2028 (from $2.2bn to $5.5bn), highlighting one of several growth opportunities among the categories that the ETF invests in.[1]

Structural Tailwinds
The ETF aims to provide exposure to materials that are core to powering disruptive innovations, leading to potentially greener and more efficient transportation, energy, and manufacturing systems.

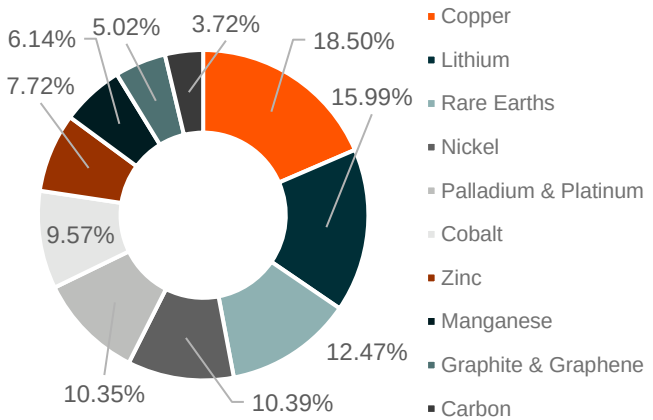
Unconstrained Approach
The universe of companies involved in the supply of disruptive materials defies traditional categorisation. The ETF invests accordingly, with global exposure across multiple sectors and industries.

Key Facts[2]

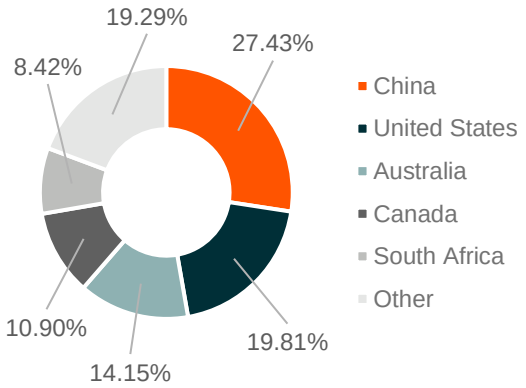
Inception Date:	September 07, 2022	**AUM:**	$11,271,911
Index:	Solactive Disruptive Materials v2 Index	**Index Ticker:**	SOLDMAT2
Total Expense Ratio:	0.50%	**Ongoing Charges:**	0.50%
Primary ISIN:	IE000FP52WM7	**Domicile:**	Ireland
Registered Countries:	Austria, Denmark, Finland, Germany, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom	**Listing Exchanges:**	London Stock Exchange, Deutsche Börse Xetra, Borsa Italiana, SIX Swiss Exchange, Bolsa Mexicana De Valores
		SFDR Classification	Article 6
Number of Holdings:	49	**Management Style:**	Physical - Full Replication – Passively Managed

Key Characteristics[3]

Thematic Segment Breakdown



Country Breakdown[4]



Top 10 Holdings

Name	Weight %
IGO Ltd	5.09%
First Quantum Minerals Ltd	4.80%
Allkem Ltd	4.66%
Freeport-McMoRan Inc	4.40%
Albemarle Corp	4.30%
Southern Copper Corp	4.21%
Antofagasta PLC	4.11%
Lundin Mining Corp	3.89%
Anglo American PLC	3.71%
Livent Corp	3.69%

Sources: 1. FortuneBusiness Insight, Jun 2021.; 2. Global X ETFs, Morningstar, as of 30/06/2023.; 3. Ibid.; 4. Other. United Kingdom (7.8%), Japan (5.4%), Sweden (3.1%), Netherlands (1.2%), Indonesia (0.6%), France (0.6%), Germany (0.4%).

Global X Disruptive Materials UCITS ETF (DMAT LN)

The Global X Disruptive Materials ETF (DMAT LN) seeks to invest in companies producing metals and other raw materials that are essential to the expansion of disruptive technologies, such as lithium batteries, solar panels, wind turbines, fuel cells, robotics, and 3D printers. Targeted materials include companies involved in the exploration, mining, production and/or enhancement of Rare Earth Materials, Zinc, Palladium & Platinum, Nickel, Manganese, Lithium, Graphene & Graphite, Copper, Cobalt & Carbon Fiber.

Underlying Index Selection Process

1. **Create Initial Universe**
   - Primary listing in Developed or Emerging Markets, excluding India
   - Market Cap ≥ $100 million / 6M Average Daily Traded Value ≥ $1 million
2. **Sub-Theme Revenue Criteria**
   - Index provider narrows universe to companies that generate ≥ 50% of revenues from **disruptive material-related sub-themes**
   - May add Pre-Revenue companies that have primary business operations in disruptive material activities and/or Diversified companies that derive <50% of revenues from disruptive material activities.
3. **Ranking Cutoff**
   - Up to the 5 highest-ranking Pure-Play and Pre-Revenue companies according to free float market cap from each disruptive material are included. For Lithium, the top 5 can also include Diversified companies.
4. **Weighting/Rebalance**
   - Free float market cap weighting scheme
   - Each component have Maximum weight = 4%, Minimum weight = 0.3%
   - The aggregate weight of Pre-Revenue and Diversified companies cannot exceed 10% of the index weight.
   - Semi-Annual rebalance

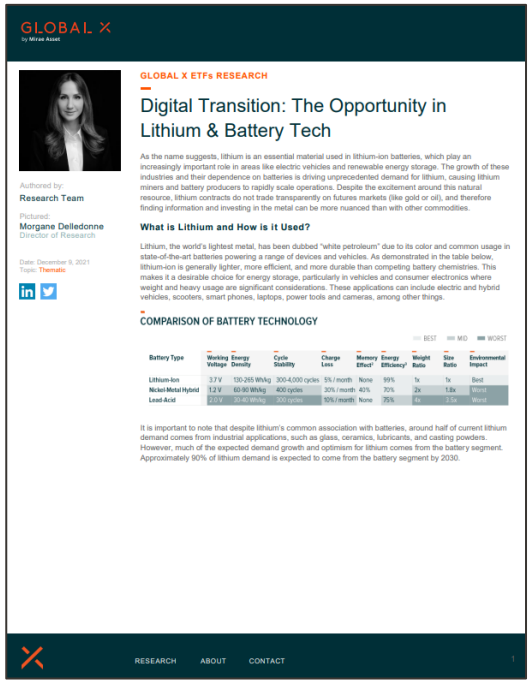
DMAT LN Sub-Themes

- Exploration and Mining
- Production of Disruptive Materials
- Enhancements of Disruptive Materials

Full Index Methodology: Solactive Disruptive Materials v2 Index

Global X ETFs

Additional thematic insights can be found online at:
***globalxetfs.eu/insights**, or on Twitter: **@MDelledonne_gx**, **@PPalandrani_gx**, **@ROliver_gx** and **@Flomba_gx**.*



GLOBAL X
by Mirae Asset

GLOBAL X ETFs RESEARCH

Digital Transition: The Opportunity in Lithium & Battery Tech

Authored by:
Research Team

Pictured:
Morgane Delledonne
Director of Research

Date: December 9, 2021
Topic: Thematic

As the name suggests, lithium is an essential material used in lithium-ion batteries, which play an increasingly important role in areas like electric vehicles and renewable energy storage. The growth of these industries and their dependence on batteries is driving unprecedented demand for lithium, causing lithium miners and battery producers to rapidly scale operations. Despite the excitement around this natural resource, lithium contracts do not trade transparently on futures markets (like gold or oil), and therefore finding information and investing in the metal can be more nuanced than with other commodities.

What is Lithium and How is it Used?

Lithium, the world's lightest metal, has been dubbed "white petroleum" due to its color and common usage in state-of-the-art batteries powering a range of devices and vehicles. As demonstrated in the table below, lithium-ion is generally lighter, more efficient, and more durable than competing battery chemistries. This makes it a desirable choice for energy storage, particularly in vehicles and consumer electronics where weight and heavy usage are significant considerations. These applications can include electric and hybrid vehicles, scooters, smart phones, laptops, power tools and cameras, among other things.

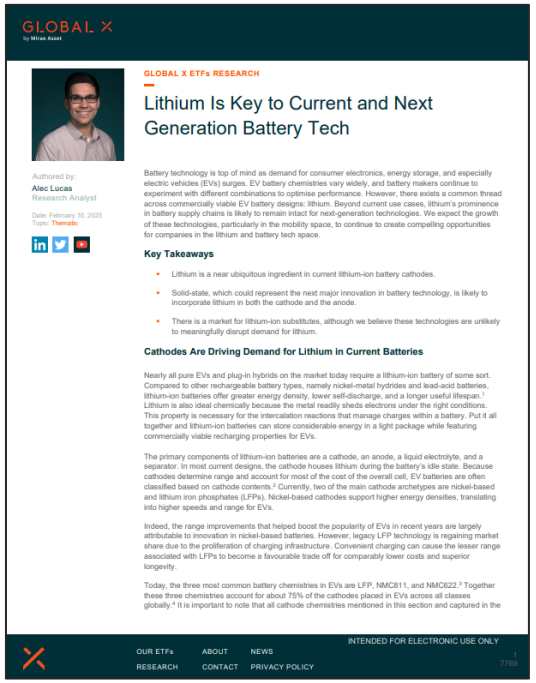
COMPARISON OF BATTERY TECHNOLOGY

BEST MID WORST

Battery Type	Working Voltage	Energy Density	Cycle Stability	Charge Loss	Memory Effect	Energy Efficiency	Weight Ratio	Size Ratio	Environmental Impact
Lithium-ion	3.7 V	130-265 Wh/kg	300-4,000 cycles	5% / month	None	99%	1x	1x	Best
Nickel-Metal Hybrid	1.2 V	60-80 Wh/kg	400 cycles	30% / month	40%	70%	2x	1.8x	Worst
Lead-Acid	2.0 V	30-40 Wh/kg	300 cycles	10% / month	None	75%	4x	3.5x	

It is important to note that despite lithium's common association with batteries, around half of current lithium demand comes from industrial applications, such as glass, ceramics, lubricants, and casting powders. However, much of the expected demand growth and optimism for lithium comes from the battery segment. Approximately 90% of lithium demand is expected to come from the battery segment by 2030.

RESEARCH ABOUT CONTACT



GLOBAL X
by Mirae Asset

GLOBAL X ETFs RESEARCH

Lithium Is Key to Current and Next Generation Battery Tech

Authored by:
Alec Lucas
Research Analyst

Date: February 10, 2023
Topic: Thematic

Battery technology is top of mind as demand for consumer electronics, energy storage, and especially electric vehicles (EVs) surges. EV battery chemistries vary widely, and battery makers continue to experiment with different combinations to optimise performance. However, there exists a common thread across commercially viable EV battery designs: lithium. Beyond current use cases, lithium's prominence in battery supply chains is likely to remain intact for next-generation technologies. We expect the growth of these technologies, particularly in the mobility space, to continue to create compelling opportunities for companies in the lithium and battery tech space.

Key Takeaways

- Lithium is a near ubiquitous ingredient in current lithium-ion battery cathodes.
- Solid-state, which could represent the next major innovation in battery technology, is likely to incorporate lithium in both the cathode and the anode.
- There is a market for lithium-ion substitutes, although we believe these technologies are unlikely to meaningfully disrupt demand for lithium.

Cathodes Are Driving Demand for Lithium in Current Batteries

Nearly all pure EVs and plug-in hybrids on the market today require a lithium-ion battery of some sort. Compared to other rechargeable battery types, namely nickel-metal hydrides and lead-acid batteries, lithium-ion batteries offer greater energy density, lower self-discharge, and a longer useful lifespan.[1] Lithium is also ideal chemically because the metal readily sheds electrons under the right conditions. This property is necessary for the intercalation reactions that manage charges within a battery. Put it all together and lithium-ion batteries can store considerable energy in a light package while featuring commercially viable recharging properties for EVs.

The primary components of lithium-ion batteries are a cathode, an anode, a liquid electrolyte, and a separator. In most current designs, the cathode houses lithium during the battery's idle state. Because cathodes determine range and account for most of the cost of the overall cell, EV batteries are often classified based on cathode contents.[2] Currently, two of the main cathode archetypes are nickel-based and lithium iron phosphates (LFPs). Nickel-based cathodes support higher energy densities, translating into higher speeds and range for EVs.

Indeed, the range improvements that helped boost the popularity of EVs in recent years are largely attributable to innovation in nickel-based batteries. However, legacy LFP technology is regaining market share due to the proliferation of charging infrastructure. Convenient charging can cause the lesser range associated with LFPs to become a favourable trade off for comparably lower costs and superior longevity.

Today, the three most common battery chemistries in EVs are LFP, NMC811, and NMC622.[3] Together these three chemistries account for about 75% of the cathodes placed in EVs across all classes globally.[4] It is important to note that all cathode chemistries mentioned in this section and captured in the

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GLOBAL X

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Appendix

Minerva: Company Profile

Company Overview

- Minerva is an independent provider of global research and proxy voting solutions.
- Minerva works closely with institutional investors to support and enable their own unique vision of responsible investment through the provision of high-quality data and stewardship support services.
- Minerva understands that in order to make sustainable stewardship into a concrete reality, institutional investors need high-quality, actionable data and informed insights. The company, therefore, blends a deep knowledge of its clients' investing context alongside advanced skills and capabilities in the field of data science and knowledge management.
- Minerva offers a suite of sustainability support services covering the following competencies and deliverables:
  - Expert ESG data collection and analysis
  - Governance, remuneration and sustainability analysis
  - Vote agency administration services
  - Comprehensive knowledge of global market voting procedures
  - Post-event vote results, monitoring and reporting
  - SDG and ESG framework alignment
  - Sustainable stewardship and engagement services

Minerva: Company Profile

Minerva ESG Nexus

- Minerva ESG Nexus is a modern, **ESG research and analysis framework** which moves beyond traditional negative screening to combine a comprehensive range of regulation and investor-led ESG monitoring practices.
- Based on the three pillars of 'products', 'conduct' and 'governance', the Minerva ESG Nexus framework offers a comprehensive, data-driven approach to embed the **UN Global Compact**, **UN Sustainable Development Goals** and **TCFD** recommendations into a range of investment activities.
- Minerva Nexus allows investors to explicitly screen portfolios and companies based on clearly defined products and ESG criteria. Furthermore, investors can identify top-performing or laggard companies on key topics such as executive remuneration, governance and/or sustainability, based on Minerva's tried and trusted objective rating system. As a basis for engagement and voting, indicators can be embedded in custom voting policies.
- Rather than imposing a one-size-fits-all approach, Minerva Nexus allows users to explore a full range of topics and develop their own approach, confident that the data is objective and rigorous.
- Minerva Nexus is, however, not merely an AI web-scraping technology solution. Expert analysis using trusted primary resources is central to the offering.

Minerva: ESG Screening

The index methodologies that the Global X sustainable themes ETFs track contain **two** ESG screens carried out by Minerva, details below:

1 Controversial Products

A controversial product screen reviews companies on their involvement in controversial products. Each type of controversial product has different thresholds to identify involvement, which if reached, may warrant an exclusion.

Controversial products are those which pose a material risk due to a large portion of investors perceiving them as offensive, embarrassing, harmful, socially unacceptable, or ethically objectionable.

The following areas can be included in a controversial product ESG screen:

- **Weapons**
  - Controversial Weapons: Depleted Uranium, Nuclear Weapons, Cluster Munitions, Anti-Personal Mines, White phosphorus weapons and Military & tailor-made products for weapons.
  - Small Arms: Civilian firearms.
- **Energy**
  - Fossil Fuels: Coal, Conventional and Unconventional Oil & Gas
- **Controversial Activities**
  - Palm Oil, Prisons, Adult Entertainment
- **Public Health Concerns**
  - Recreational Cannabis, Tobacco, Alcohol, Gambling

2 United Nations Global Compact

This screen includes reviewing **company adherence to the UN Global Compact Principles (UNGC)**.

The UNGC pillars are underpinned by Ten Principles which promote the integration of sustainable business practices and transparency.

8,000 companies and 4,000 non-business participants have become signatories to UN Global Compact.

Companies are screened under the following four pillars of the UNGC (including company supply chains):

- Human Rights
- Labour Rights
- Environmental Damage
- Anti-Corruption

Minerva: United Nations Global Compact

- Minerva references the United Nations Global Compact (UNGC) Principles and the Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises to assess the behaviour of companies.
- In addition to looking at formal breach notifications, Minerva undertakes a comprehensive, expert research process using a range of primary and secondary sources including online media, NGO data, corporate disclosures and official government sources. Sources are screened weekly and detailed audit trails are kept over time.
- There are four pillars that are reviewed as part of the UNGC screen: 1) Human Rights, 2) Environmental Damage, 3) Labour Rights and 4) Anti-Corruption.
- Minerva has developed a Materiality tool which they use to carry out a review of a company including its supply chain. The Materiality tool allows for the categorisation of events and/or companies that may breach the above fundamental responsibilities.
- The tool assesses potential UNGC breaches across two dimensions: Severity (Severe, High, Moderate, Minor) and Frequency.
- Based on the determined severity and frequency of the breach, the company is given a score as shown in the Table below:

Severity Level		Definition	Score
	Severe	Indicates an action by a company that results in a severe impact on society and/or the environment. Events assigned to this category represent the most controversial corporate behaviour.	20
	High	Indicates an action by a company that results in a large impact on society and/or the environment	10
	Moderate	Indicates an action by a company that results in a moderate impact on society and/or the environment.	4
	Minor	Indicates an action by a company that results in low impact on society and/or the environment	2
	None	There is no evidence that a company is involved in any controversy.	0

Minerva: United Nations Global Compact

- Minerva evaluates whether a company has taken the appropriate steps to remediate the identified issue going forward. To this end, the frequency of the alleged offence is objectively assessed in order to adjust the final severity level score which can be seen by the Severity-Frequency Matrix.
- Minerva evaluates whether a company has taken the appropriate steps to remediate the identified issue going forward. To this end, the frequency of the alleged offence is objectively assessed in order to adjust the final severity level score which can be seen by the Severity-Frequency Matrix.
- The decision for exclusion is based on relevance, frequency, the scope of the harm, severity, risk of recurrence and the irreversibility of the adverse impact caused by the company and by using Minerva's predefined materiality framework to ensure consistency in the evaluation process.
- Exclusion is applied where companies clearly fail to demonstrate change or improvements that can mitigate and/or prevent any adverse impact. If an excluded company demonstrates a positive change that reduces the risk of recurrence, the company may be re-included, and an Observation score is applied accordingly.
- **Exclusions**: any Company that receives a severity score of 20 (Severe) will be excluded from the Index. A severity level score of 'Severe' indicates an action completed by a company that has had a severe impact on society and/or the environment.

Frequency
How many time the issue has occurred?

Severity Level
How severe the issue is?

	x1	x2	x3	x4	x5+
Severe 20	Severe 20	Severe 40	Severe 60	Severe 80	Severe 100+
High 10	High 10	Severe 20	Severe 30	Severe 40	Severe 50+
Moderate 4	Moderate 4	Moderate 8	High 12	High 16	Severe 20+
Minor 2	Minor 2	Moderate 4	Moderate 6	Moderate 8	High 10+
None 0	None 0	None 0	None 0	None 0	None 0

How supply chains are assessed

- If there is a violation in the supply chain of a company, there would be a 'High' Severity score of 10 applied. If a company has more than one incidence of a 'High' severity case, Minerva will increase their Severity Score to 'Severe' (as seen above). This then moves the company from an 'Observation' to an 'Exclusion'.
- The multiplicative scoring system applies to multiple violations within the same UNGC pillar, i.e., two labour rights violations or two human rights violations. Please see the criteria below regarding the violation of UNGC principles in the supply chain:

Human Rights:	Companies with confirmed violations in their supply chain.
Environmental Damage:	Companies with impactful environmental damage in their supply chain.
Labour Rights:	Companies with confirmed cases of labour rights violations in the supply chain.
Anti-corruption:	Companies associated with another company confirmed or bribery or corruption.

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Appendix – Disruptive Materials

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