Tech to Finance: Commodities Deep-Dive

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Alberto Spina

Outline & Structure

At a high level today's talk is structured as follows:

1. Trading Environment and **Team Dynamics**.
2. Introduction to **Commodity Derivatives**.
3. **Market Participants** and Operations.
4. Commodities **Market Deep Dive**.
5. Commodities **Market Anomalies**.
6. Technological **Innovations** in Finance.

This is a narrative of my personal journey from naive/tech-focused Software Engineering to Front-Office Commodities Trading.

Takeaway Goals

By the end of this talk there should be three key takeaways:

1. **Insight into Commodities Trading**: Understand the **fundamental aspects of commodities trading**, including the different roles (traders, researchers, technologists), trade lifecycle, and the significance of derivatives.
2. **Recognize the Skills and Expertise Needed**: Identify the skill sets required in the commodities space, such as **analytical abilities**, understanding of **market dynamics,** technological proficiency, and the ability to innovate and adapt to market changes.
3. **Adapting Recruitment to Technological Evolution**: Emphasize the importance of recruiting individuals who are not only technically proficient but also **adaptable to technological innovations** and willing to challenge themselves.

Personal Background

I'm a **Software Engineer** in the Commodities Pricing Team **at Citadel**.

Ex-Two Sigma, where I worked in two teams:

1. VENN: External portfolio analysis platform.
2. TSIQ: Mothership spinoff in the insurance domain. Startup-vibe.

Imperial College Alumni (industrial placement at **G-Research**).

I'm a mentor to university students interested in applying for STEM education, or looking for STEM-based careers.

Trading Environment and Team Dynamics

Front Office Overview

Composition of a Front Office Trading Team:

- **Traders**: Decision-makers on buying/selling.
- **Researchers**: Analysts providing mathematical models for decision support.
- **Engineers**: IT and software development to empower and assist operations.
- **Operations**: Smooth execution of trading activities.

Trading Approaches

- **Discretionary Trading**: Relying on trader expertise to make trading decisions.

  A trader decides to buy wheat futures based on weather forecasts affecting crop outputs.

- **Systematic Trading**: Utilizing algorithms/models to drive trading decisions.

  An algorithm trained on historic data automatically trades oil futures based on real-time data analysis.

- **Semi-Systematic Trading**: Algorithms provide guidance, but humans make the final trade decisions, balancing algorithmic efficiency with human insight.

  A human decides on final trades informed by algorithmic recommendations on gas prices.

Trade Lifecycle

Let’s break down the term “trading”.

FRONT OFFICE

BACK OFFICE

- **Initiation**: Starting a trade (backed by fundamentals and/or models).
- **Execution**: The trade is carried out in real-time using internal/external tools.
- **Clearing**: Counterparty obligations are established.
- **Settlement**: Final transfer of securities and cash.

At a high level these apply to both discretionary and systematic traders and strategies.

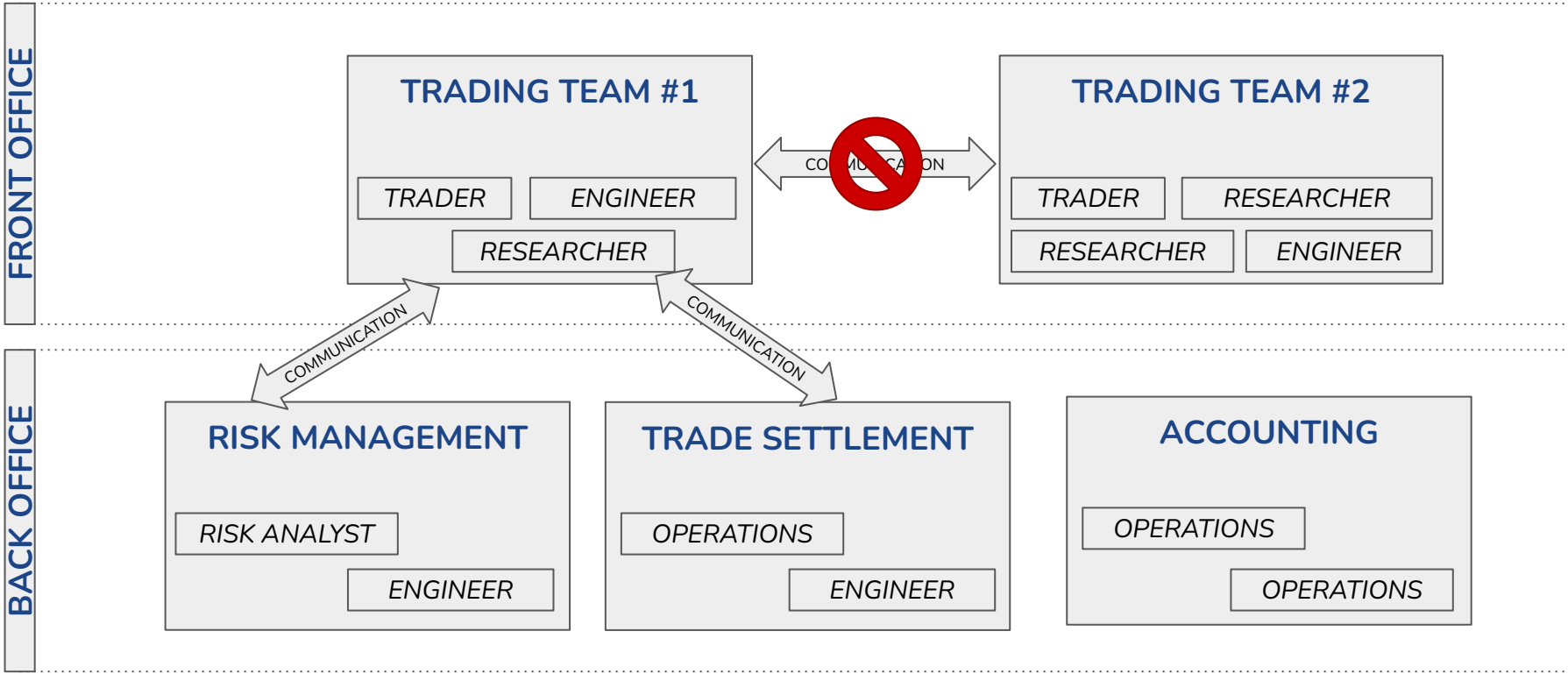
Back Office Overview

The “Back Office” team(s) carry out diverse and critical responsibilities:

- **Risk Management**: Identifying and mitigating risks in the currently held positions/books.
- **Settlement Process**: Ensuring trades are settled accurately with counterparties.
- **Support Operations**: Regulatory compliance, accounting.

In these roles we see roles such as **specialized analysts, operations and engineers.**

High-Level Example



Front-Office Team Dynamics

1. **Collaboration**:
    a. **Traders communicate strategies** and requirements to Researchers and Engineers.
    b. **Researchers provide analytical support**, model predictions, and strategy optimizations.
    c. **Engineers** develop and **maintain software** solutions to challenges faced by researchers, ensuring efficient execution of models.
2. **Communication**:
    a. Focuses on swift alignment with the Trader's/Researcher's demands, emphasizing efficiency.
3. **Culture**:
    a. Defined by a **results-driven ethos** under the Trader's leadership, balancing a relaxed atmosphere with the crucial expectation of performance.
    b. Success is paramount, directly impacting team stability.

The Wide Spectrum of Researcher Roles

There are many roles that tend to be conflated into the term “Researcher”:

1. **Analyst**: Focus on market research and fundamental analysis to provide macroeconomic insights and company-specific research.
2. **Quantitative Analyst (Quants)**: Specialize in mathematical models and algorithmic trading strategies to develop predictive models and manage risk.
3. **Data Scientist**: Use big data analytics to extract insights and predict market movements through pattern recognition and statistical analysis.

The Wide Spectrum of Engineer Roles

There are many roles that tend to be conflated into the term “Engineering”:

1. **Data Engineers**: Essential in big data analytics, data warehousing, and real-time data processing for trading insights.
2. **Software Engineers**: Beyond system maintenance - they innovate trading algorithms, develop custom tools for analysis, and ensure cybersecurity.
3. **Quantitative Developers (QuantDevs)**: Work closely with researchers to implement algorithms, perform back-testing, and apply machine learning for predictive modeling.

Introduction to Commodities Derivatives

Derivatives Overview

Derivatives are financial instruments whose value is derived from the value of an **underlying asset**. There are multiple common types:

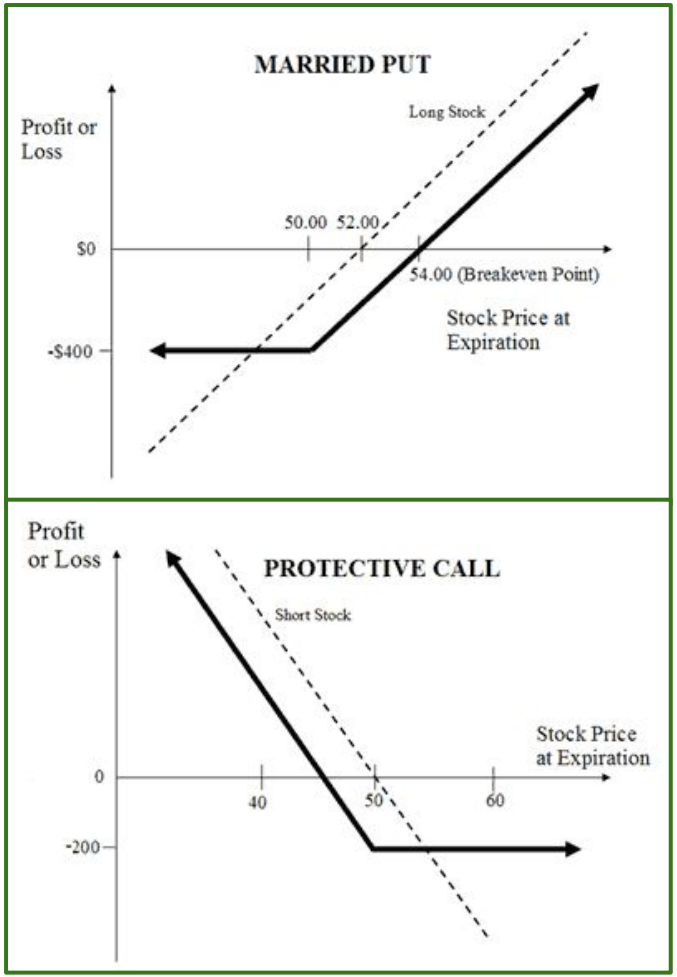
- **Futures/Forwards**: Contracts to **buy/sell** a commodity **at a future date**. Futures are standardised and exchange-traded. Forwards are customized and traded OTC.
- **Swaps**: Contracts to **exchange cash flows** based on the underlying's price movements.
- **Options**: Contracts that give the buyer the **right, but not the obligation**, to buy/sell a commodity at a predetermined price before or at a future date.

Derivatives are used to hedge against price volatility, speculation, and obtaining exposure to commodities without physical trading.

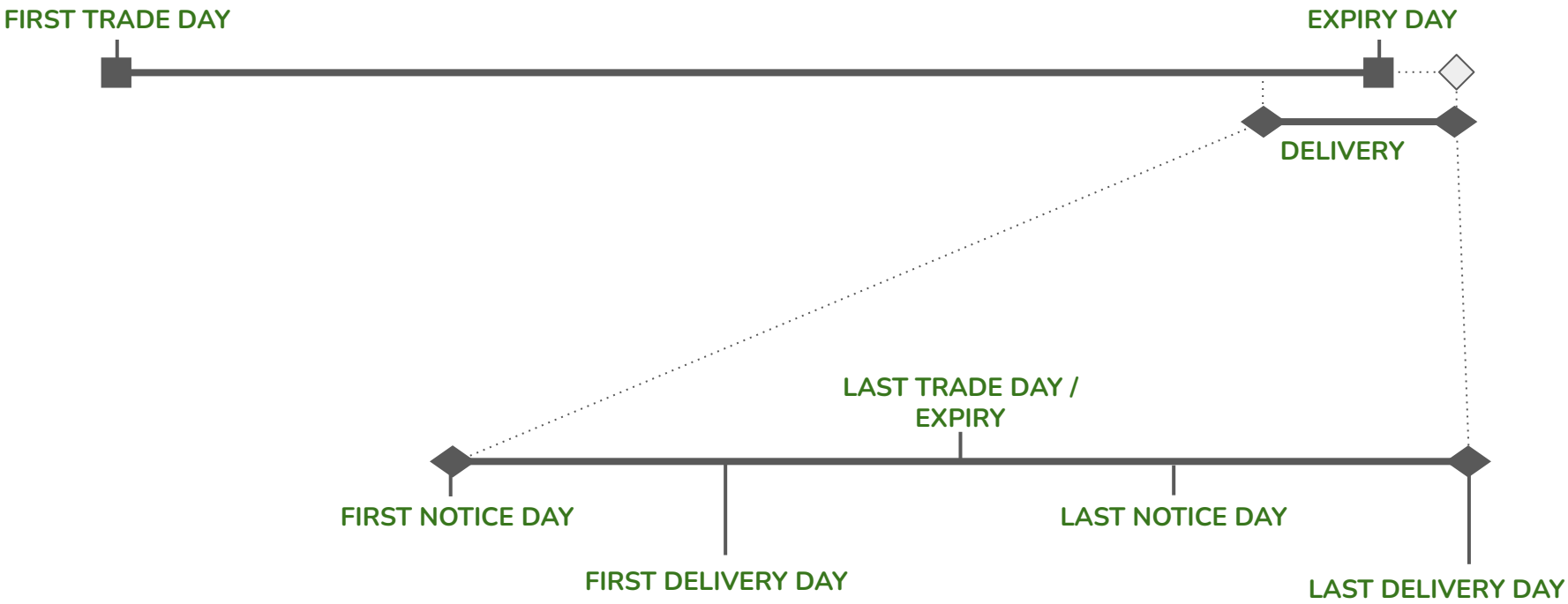
Risk Management Strategies

Effective risk management in commodities trading involves the **use of derivative instruments like futures, options, and swaps** to **hedge against market volatility** and unexpected events.

Beyond derivatives, diversification across commodities and the use of insurance against physical losses are critical.



Derivative Instrument Timeline



Settlement Types

Commodities derivatives have the following delivery/expiry settlement types:

- **Physical Settlement**: Where settlement entails the **actual physical delivery** of the commodity.
- **Cash Settlement**: Settlement is performed via a **cash payment** based on the price movement of the commodity, without physical delivery.

Settlement type is predetermined in the contract specifications.

You also have **Daily Settlement (Marking to Market)**: Adjusting the value of positions daily to reflect market prices, ensuring fairness and reducing risk.

Physical vs. Derivative (Paper) Trading

Commodities are traded differently by different audiences:

- **Physical Trading**: Involves the **buying**, **selling**, and **delivery** of the physical commodity.
- **Derivative (Paper) Trading**: Trading contracts that derive their value from the **price movements** of the commodity. Known as paper trading, this form of trading facilitates hedging, speculation, and leverage without the logistical challenges of physical delivery.

Derivatives expand market participation beyond those directly involved in physical commodity movements and provide mechanisms to mitigate price volatility risk.

Trading Platforms and Mechanisms

Trading either takes place on:

- **Exchanges** which provide a centralized marketplace with standardized contracts offering liquidity and transparency.
- **Over the Counter (OTC)** which involves direct transactions between parties with customized terms. It is preferred for **customized deals**, privacy, and flexibility.

Exchange Clearing is the mechanism which involves the clearinghouse acting as the **counterparty** to both sides of a transaction, ensuring trade integrity and mitigating default risk.

Market Participants and Operations

Asset Managers

- **Definition**: Firms **focusing on commodity investments**, with teams of analysts, traders, and portfolio managers.
- **Role**: Invest in commodities for **portfolio diversification** and inflation hedging.
- **Strategies**:
  - Utilize a mix of direct **physical commodity investments and commodity derivatives** (futures, options) for portfolio diversification and risk management.
  - Often engage in over-the-counter (**OTC**) deals for bespoke solutions and direct agreements with producers or consumers.

Market Makers

- **Definition**: Market makers are entities that **provide liquidity** to the market by always being ready to buy or sell commodities at publicly quoted prices.
- **Role(s)**:
  - Facilitate **smoother transaction flows** in commodity derivatives markets, especially in less liquid markets.
  - Operate on major commodity exchanges and in OTC markets, adjusting spreads based on market volatility and liquidity demands.
- **Strategies**: Enhance liquidity by continuously providing buy and sell quotes, ensuring traders can execute positions without excessive price movement.

High Frequency Traders (HFTs)

- **Definition**: HFTs use advanced algorithms and **high-speed** data networks to trade commodities, capitalizing on small price movements.
- **Role(s)**:
  - Contribute to **market efficiency** through rapid price discovery and liquidity provision.
  - Significant presence in futures markets, where their speed can influence price movements and volatility.
- **Strategies**: Employ algorithmic trading strategies in commodity futures and derivatives to **exploit small price differences**, often holding positions for very short durations.

Operational Methodologies

- **Asset Managers**:
  - Focus on **long-term value and fundamentals** in commodities, such as supply-demand dynamics, geopolitical factors, and macroeconomic trends.
  - **OTC deals** allow for customized strategies beyond public markets.
  - May take **physical delivery**.
- **Market Makers**: Provide continuous quotes in commodity markets, crucial for **maintaining trading activity and liquidity**, especially in less liquid or emerging commodities.
- **HFTs**: Fast **algorithmic strategies** adapted to the specific characteristics of commodity markets (purely paper trading).

Commodities Market Deep Dive

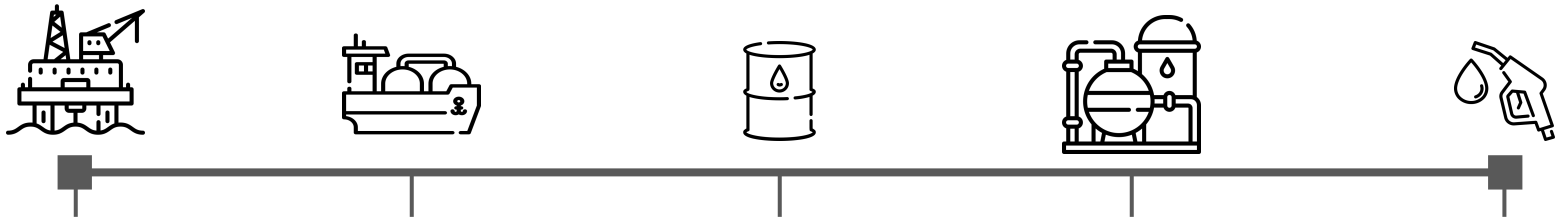
Commodity Balances

In commodity markets, prices are determined by a **delicate balance** of supply, demand, and storage.

- **Supply**: The quantity of a **commodity available for trade**, influenced by production levels, weather conditions, and geopolitical events.
- **Demand**: The desire and **ability of consumers to purchase a commodity**, influenced by economic activity, consumer preferences, and government policies.
- **Storage**: Acts as the pivot point, **regulating the flow** of commodities into and out of the market to maintain market stability and ensure fair pricing for both buyers and sellers.

Commodity Asset Lifecycle

Commodities perform journeys from source to delivery:



Sourcing

Identifying and obtaining raw materials

Transporting

Shifting commodities from their origin to demand locations

Storing

Preserving commodities, balancing cost against quality

Blending

Creating market-required specifications by mixing different grades

Delivery

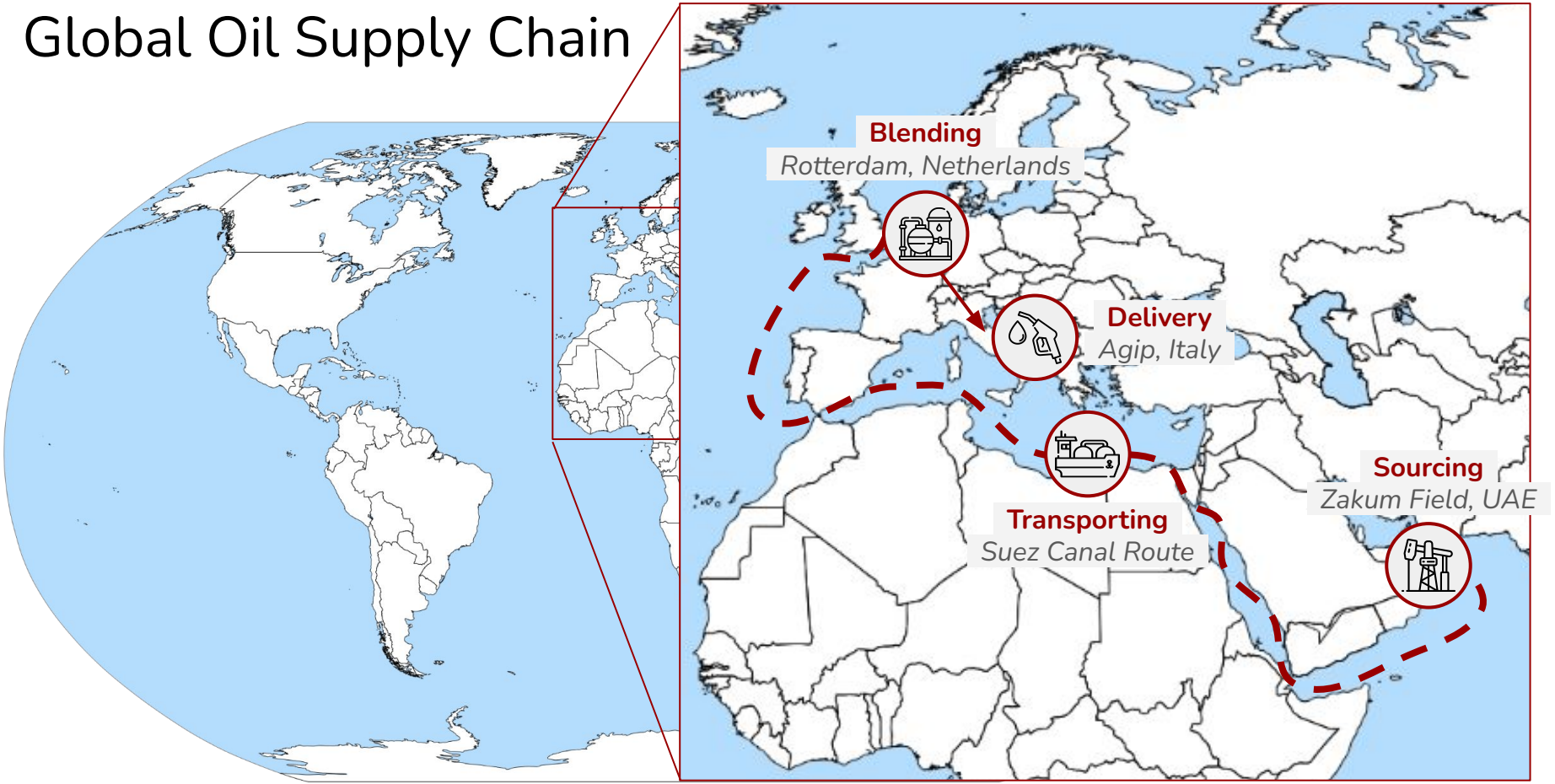
Completing contracts with the commodity's transfer to the purchaser

Commodity Markets

Global Metals Supply Chain

Commodity Markets

Global Oil Supply Chain



Commodities Market Landscape

Commodity markets are usually split and classified into:

- **Energy**: Oil, Natural Gas, Coal, Power.
- **Metals**: Precious (gold, platinum, etc) and Base (Iron Ore, Copper, etc).
- **Agricultural**: Grains, Livestock (cattle, poultry), Softs (coffee, cocoa), Bio Fuels, etc.

A large number of **Trading Venues**, amongst these NYMEX for energy, ICE for a broad range including agricultural, and LME for metals.

The **Supply Chain is Global**, often with sourcing, storage and delivery taking place across continents.

Key Market Players

The global supply chain is vast, but these are a few key participants in this space:

- **Producers**:
  - **Energy**: ExxonMobil, Chevron, BP, and Saudi Aramco
  - **Metals**: BHP, Rio Tinto, Vale, and Glencore
- **Consumers**:
  - **Energy**: Shell, TotalEnergies, Enel, and EDF.
  - **Metals**: Tesla, Samsung, Apple, and Panasonic.
  - **Agricultural**: Kraft Heinz, Nestlé, PepsiCo, and Unilever.
- **Intermediaries**:
  - **Energy**: Vitol, Gunvor, and Mercuria

Commodities Market Anomalies

What are Market Anomalies?

Market anomalies are price movements or financial market **behaviors that deviate from the common financial theory** or market efficiency.

These can arise due to **macroeconomic events**, regulatory changes, or significant incidents affecting supply and demand.

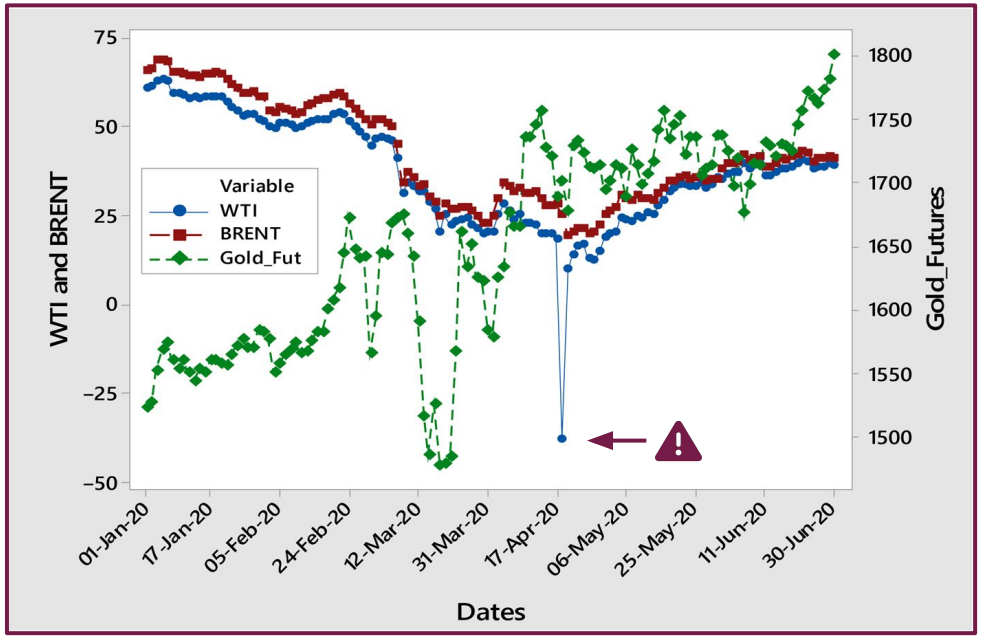
They offer traders **opportunities to profit** by anticipating corrections or risks due to increased volatility and unpredictability.

We'll explore two major anomalies: the **impact of COVID-19** on commodity prices and the subsequent **phenomenon of negative oil prices** in April 2020.

COVID-19 Impacts on Commodities

The outbreak of COVID-19 led to unprecedented **global supply chain disruptions**, reducing economic activity and affecting commodity markets.

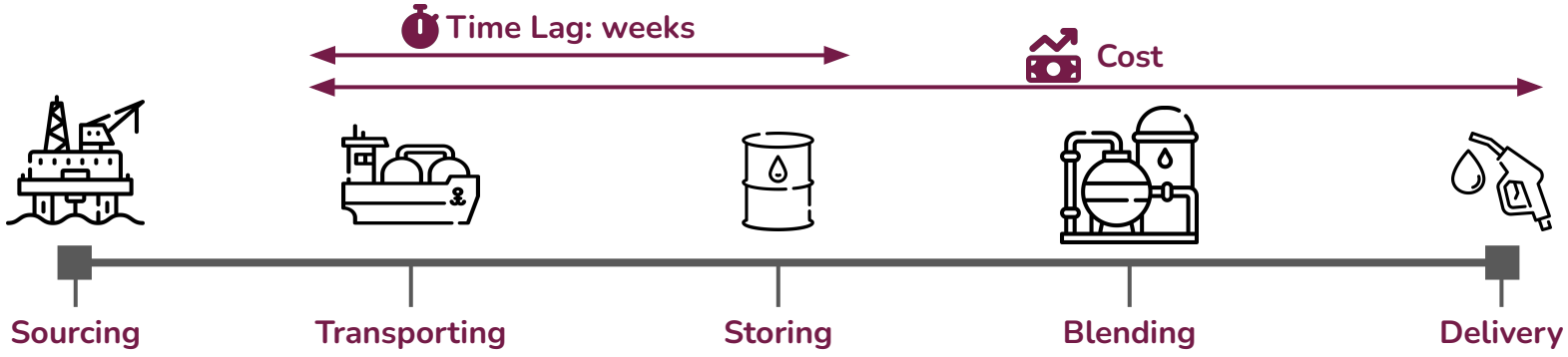
The **gold price surged to over $1,800 per ounce** in June 2020, as investors flocked to it as a safe haven amidst the uncertainty.



Negative Oil Prices - April 2020

In **April 2020**, WTI crude oil futures fell to **negative $37.63 a barrel**. This unprecedented event was caused by a **collapse in demand** due to COVID-19 lockdowns and a shortage of storage capacity for excess oil.

Let's recall the mechanics of Commodity Trading to understand why:



Geopolitical Events Impacting Commodities

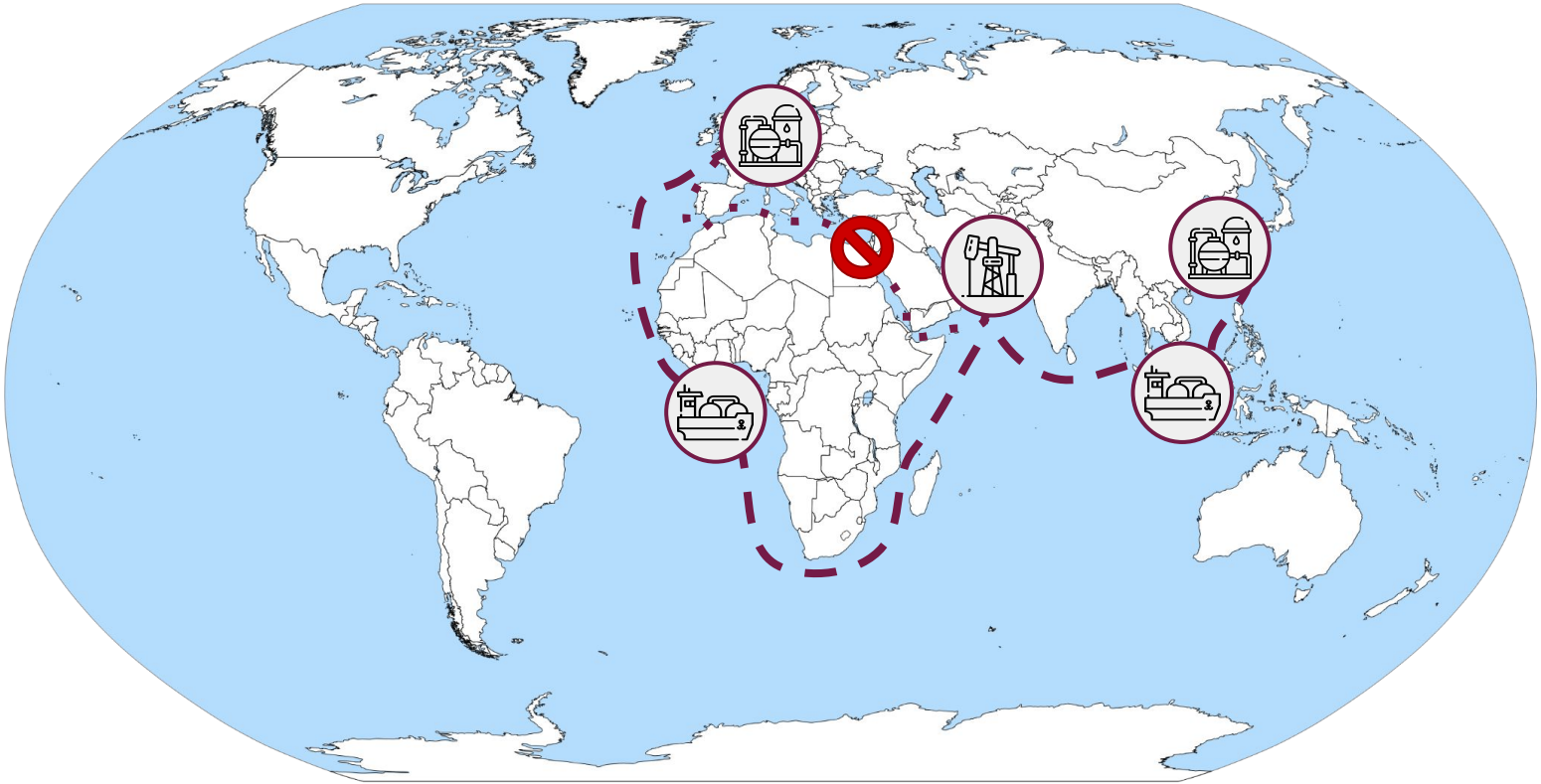
Geopolitical tensions and events, such as the ongoing **Ukraine conflict** and the **Suez Canal disruption**, significantly impact commodity markets by disrupting supply chains and altering trade routes.

The current Suez Canal disruption is causing delays in shipping routes, affecting oil prices by **rising freight insurance costs** and temporarily **increasing the costs and time of transportation**.

Alternate routes (i.e. Cape of Good Hope) mean longer journeys and fewer ships available to transport goods. Some journeys become unprofitable.

Market Anomalies

Suez Canal Rerouting

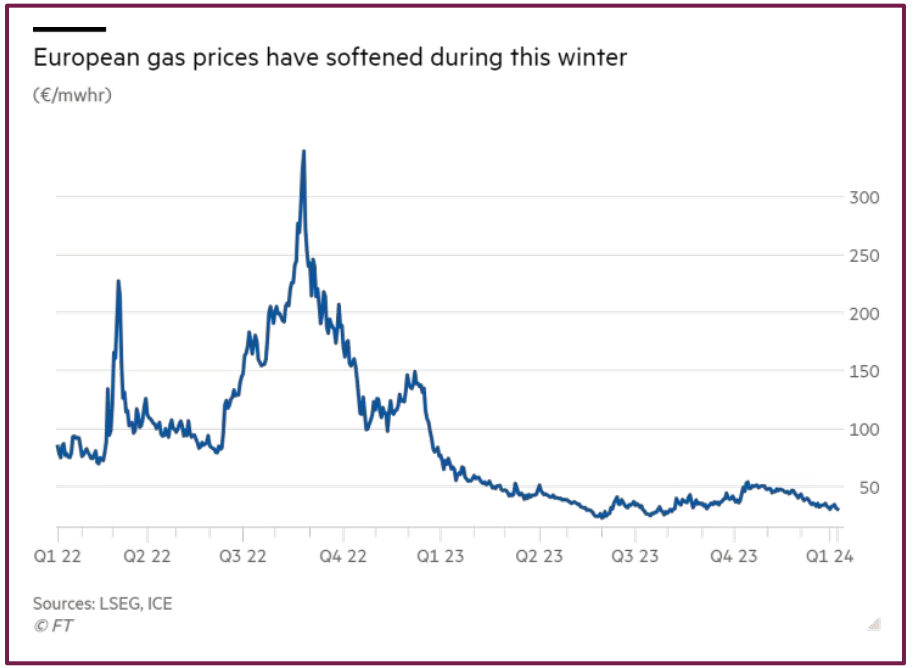


Market Anomalies

European Natural Gas Price Volatility

Following the full-scale military operation in **Ukraine**, **TTF** (Title Transfer Facility) prices experienced a notable surge driven by concerns of potential **supply disruptions**.

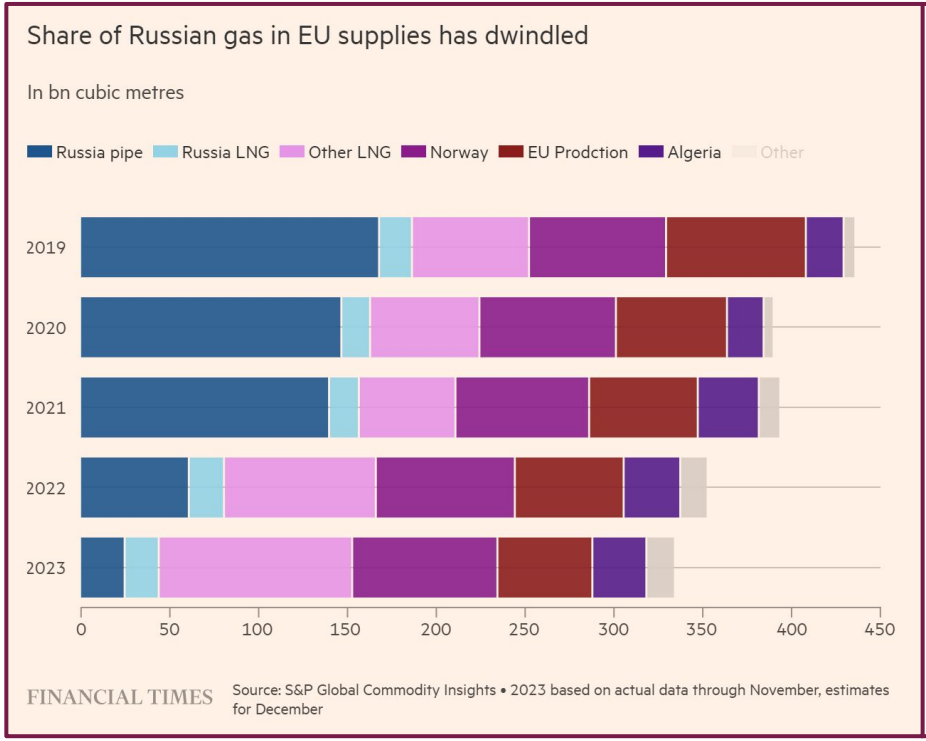
This initial spike was mitigated as the market adapted. Increased liquefied natural gas (**LNG**) **imports** played a pivotal role in balancing out the demand, offering a crucial alternative source of supply.

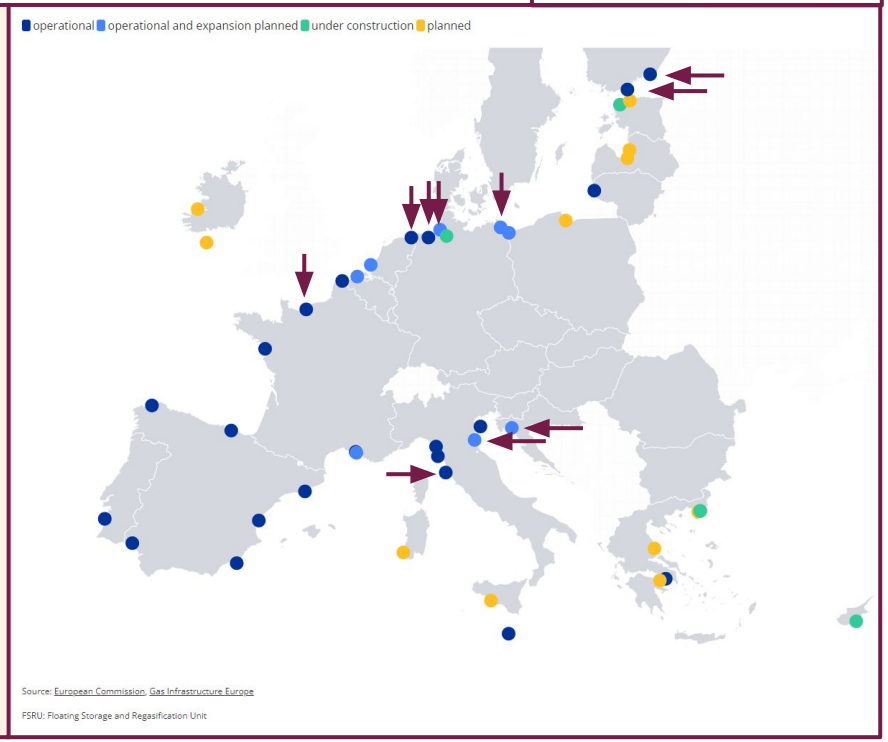


Market Anomalies

European LNG Transformation

30 Operational Terminals
10 Built post-2021
15 Planned new Terminals





Technological Innovations in Finance

Evolution of Trading Technologies

The main theme is the transition **from manual trading floors to electronic** trading.

- **1980s-1990s**: Introduction of electronic trading platforms.
- **2000s**: Emergence of algorithmic trading.
- **2010s**: Adoption of machine learning and AI in trading strategies.

There is an ongoing shift to **transition from Excel**-based analytical workflows to Python/R's complex data analysis and machine learning models for predictive analytics.

Trading Technologies and Communication Platforms

- **Trading Platforms**: They execute trades, manage portfolios, and grant access to market data. Known in this space are:
  - MetaTrader for forex and stock trading.
  - Trayport for energy commodities. Features include real-time trading, market analysis, and strategic development.
- **Communication Tools**: Information exchange across market participants (traders/brokers), market insights, and negotiation. Bloomberg Terminal and ICE Chat serve as prime examples, offering integrated trading data, news feeds, analytics, and direct communication across members

Technological Impact on Recruitment & Hiring

More hedge funds than ever are leveraging quantitative models for Alpha generation. This ranges from advanced sentiment analysis from news articles to rudimentary historic time series calculations.

There is a **shift in recruitment focus**: an increase in preference for **candidates with strong technical skills** in Python, R, data science and data intelligence, moving away from traditional finance qualifications.

The motto is to **hire smart people and train them into the domain**.

Career Opportunities for Tech Professionals in Finance

Contrary to the traditional, linear career trajectories in tech, finance opportunities are fluid and have **performance-based advancement**. Emerging roles are:

- **Quantitative Developer**: Develops algorithms and tooling alongside researchers to find trading opportunities through market data analysis.
- **Data Engineer**: Manages large datasets, data-platforms and systems for real-time, high-frequency financial analysis. This is **not a scrape-monkey**.

Contrasting the traditional Software Engineering careers, finance is a **fast-paced** professional environment where individuals are given **enormous implementation freedom and individual accountability**.

Q & A

Future Outlook

Future Outlook

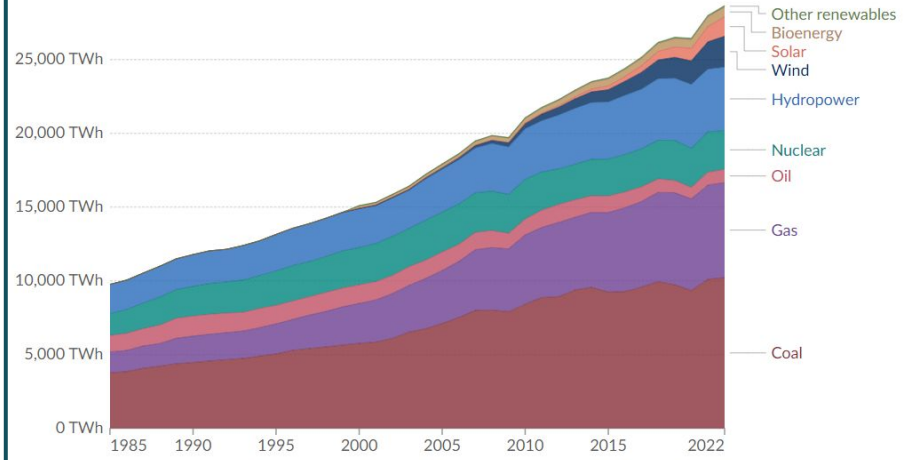
Energy Transition

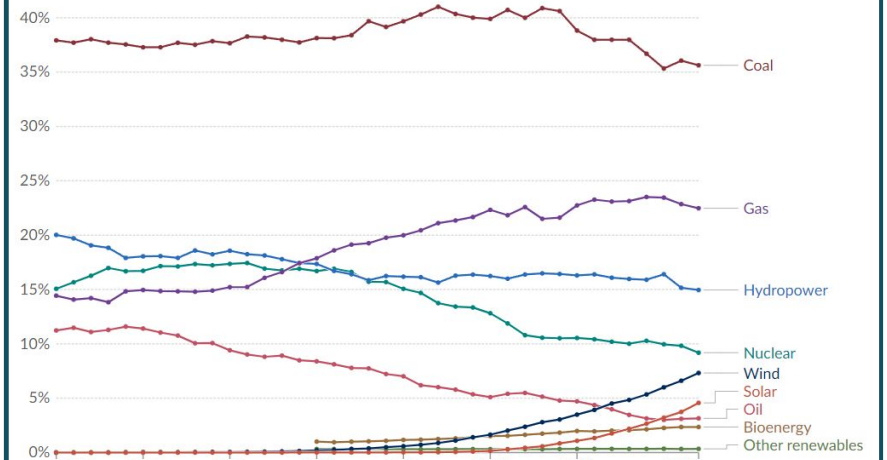
The **shift from fossil fuels to renewable energy** sources (solar, wind, hydroelectric) is reshaping the demand for traditional energy commodities and creating new markets.

- **Fossil Fuels**: Demand decreases with global carbon reduction commitments (COP28).
- **Metals Demand**: Rises due to renewable infrastructure and electric vehicles, boosting need for copper, lithium, cobalt.
- **Market Volatility**: Energy transition policies cause fluctuations in traditional energy markets.
- **New Markets**: Growth in trading of carbon credits, RECs, and commodities like green hydrogen.

Future Outlook

Global Power Generation





Future Outlook

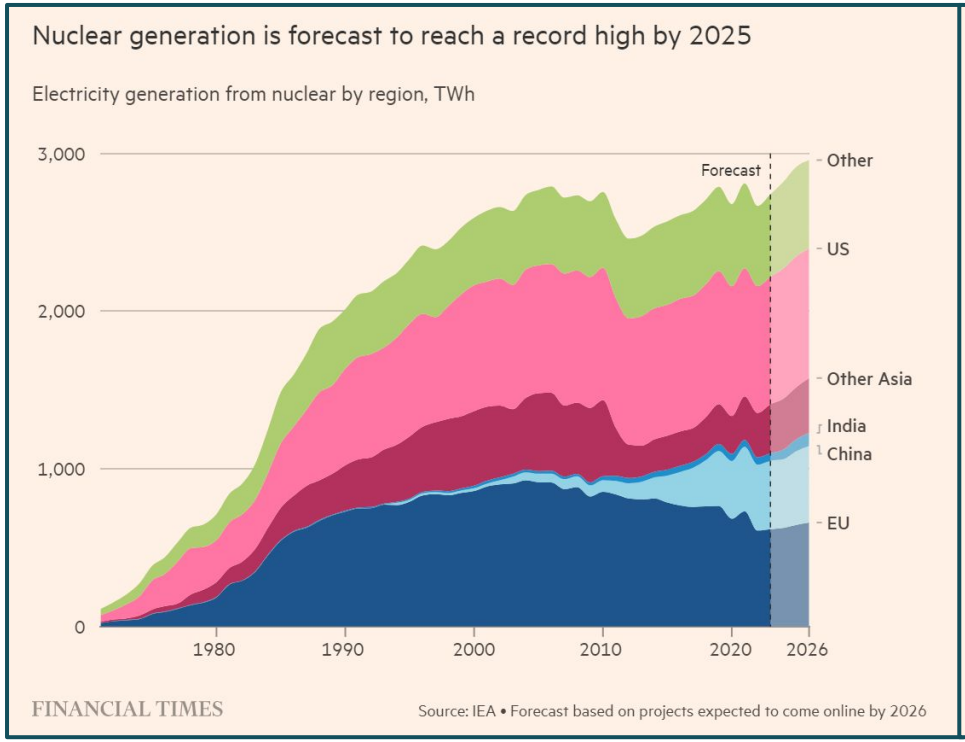
Nuclear Energy Innovations

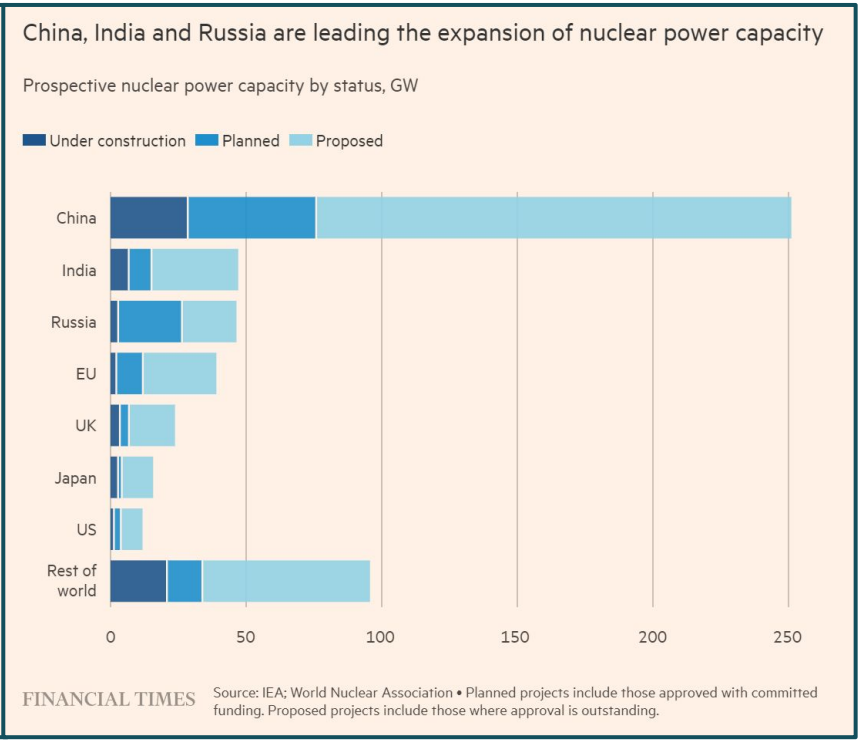
In recent decades there have been key advancements in nuclear energy, with numerous new technologies and select countries leading their development:

- **Nuclear Fusion**: Aims to produce energy by fusing two light atomic nuclei, potentially offering **limitless, clean energy** with minimal radioactive waste.
- **Small Modular Reactors (SMRs)**: Characterized by their **compact size**, these reactors can be **prefabricated and transported**, offering flexibility in location and scalability, with reduced initial investment and construction time.
- **Molten Salt Reactors (MSRs)**: Utilize liquid fuel rather than solid rods, allowing for safer operation temperatures, inherent safety features against meltdowns, and the **ability to operate more efficiently** and process nuclear waste as fuel.

Future Outlook

Global Nuclear Power Generation





Future Outlook

Engineering Workflow Evolutions

Engineering workflows are being significantly enhanced due to recent advancements in **AI technology**:

- **ChatGPT**:
  - Streamlines coding by **generating code snippets** and automating documentation, significantly reducing development time.
  - Aids in debugging and **explaining** complex concepts, enhancing learning and productivity.
- **GitHub Copilot**:
  - Delivers real-time, **context-aware code suggestions**, increasing coding efficiency and accuracy.
  - Acts as a **virtual coding assistant**, optimizing code quality and accelerating project timelines.