Energy: Trading

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Commodities

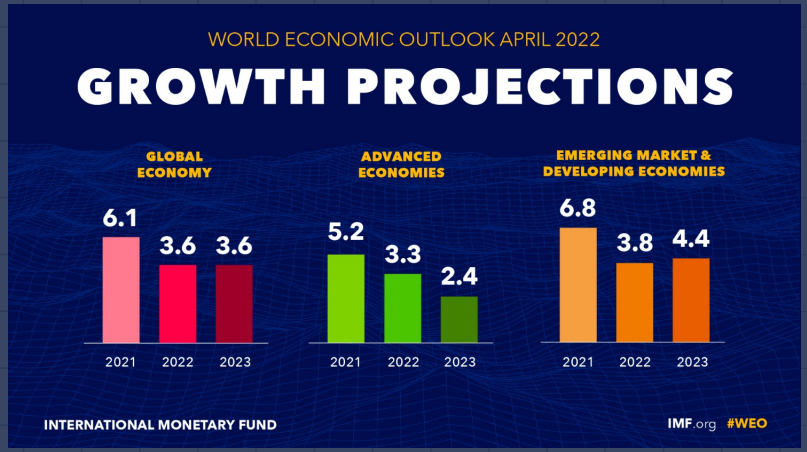
- A commodity is any marketable item produced to satisfy wants and needs
- The price of commodities is determined by global supply and demand and the quantity of the commodity.

Commodity	Description	Price Fluctuations
Crude Oil	Liquid petroleum that is found accumulated in various porous rock formations in Earth's crust and is extracted for burning as fuel or for processing into chemical products.	$0.01 per barrel
Gasoline	Refined petroleum used as fuel for internal combustion engines.	$0.0001 per gallon
Coal	Coal is a fossil fuel used mainly in power generation and steel production.	$0.01 per ton
Natural Gas	Natural gas is the earth's cleanest fossil fuel and is colorless and odorless in its natural state. It is composed of four hydrocarbon atoms and one carbon atom	$0.001 per million Btu
Electricity	Electricity powers virtually every segment of the world economy.	$0.05 per megawatt hours (MWh)
Uranium	Uranium is a radioactive metal used to produce nuclear energy.	$0.05 per pound
Ethanol	Ethanol is used as a blending fuel with gasoline.	$0.001 per gallon

Trends

Several long-term trends could create trading opportunities in energy over the next two decades:

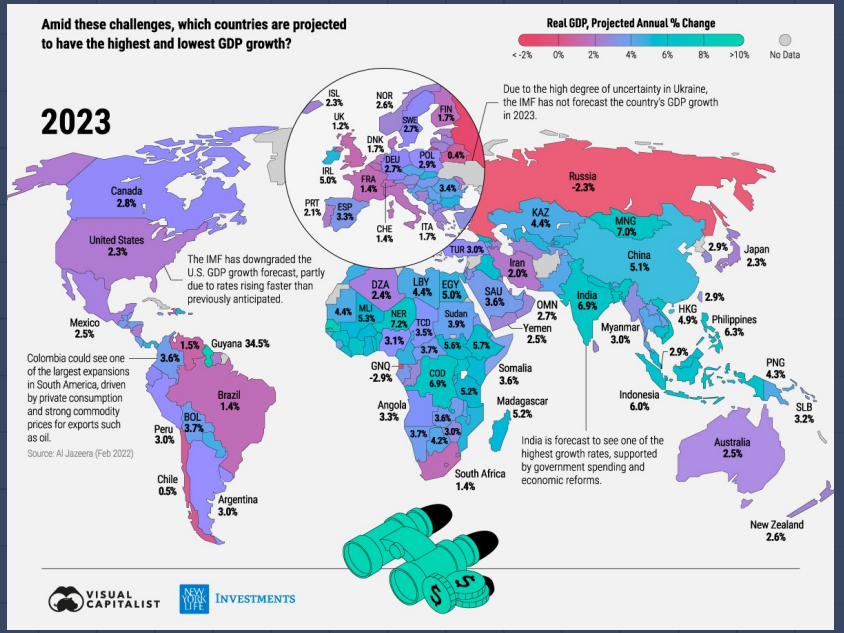
- Emerging Market Growth
- Energy Efficiency Revolution
- Population Growth
- Electricity Penetration
- Industrialization in Developing Economies



Trends

One of the most important trends in the market Is the disparity in expected energy demand between developed and developing nations.

- Global energy usage is expected to climb by nearly 30% during the next two decades
- Growth in developed nations will remain flat
- This means that emerging market nations will account for the entire increase
- This will have large ramifications for commodity markets



Trading

The buying and selling of securities (stocks, bonds, currencies, and commodities)

Popular Exchanges (Energy):

- In the US: Chicago Mercantile Exchange (CME) Group and the New York Mercantile Exchange (NYMEX)
    - CME Group is the world's leading and most diverse derivatives marketplace, handling three billion contracts worth approximately $1 quadrillion annually
        - NYMEX is one part of the CME Group
- In Europe: Intercontinental Exchange (ICE)

Trading: Derivatives- Forwards

Derivatives are a type of financial contract in which the underlying asset is an energy product (commodity).

Forwards

- A *private* agreement between a buyer and seller to trade an asset at a future date at a specified price
  - Doesn't trade on an exchange
- More flexible terms and conditions
  - number of units of the commodity and what exactly will be delivered, among other factors
- Forwards have one settlement date: the end of the contract
- Cuts down on the volatility of an asset's price
  - not subject to price fluctuations

Example:

- Producer A has an abundant supply of soybeans and is concerned that the price of the soybeans will drop
  - Producer A negotiates a contract that involves the sale of three million bushels of soybeans at a price of $5 per bushel in six months.
  - Both parties agree to settle the contract in cash.
- Soybean prices have a few ways to move by the time the contract is ready for settlement:
  1. The price is exactly as contracted. The contract is settled as per the agreement and neither party owes the other any additional money.
  2. The price is lower than the negotiated price. This means the producer's bet to hedge the risk of a price drop works and they aren't suffering a loss.
  3. The price is higher than the agreed-upon price. The contract is settled at the negotiated price, even though the producer may have profited from a higher price per barrel.

Trading: Derivatives- Futures

Derivatives are a type of financial contract in which the underlying asset is an energy product (commodity).

Futures

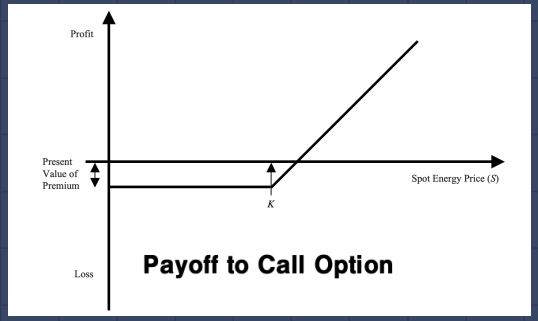
- A *public* agreement to buy and sell an asset at a specific price at a future date
  - Traded on exchanges
- The contracts are marked-to-market (MTM) daily
  - daily changes are settled day by day until the end of the contract
- Market is highly liquid
  - ability to enter and exit whenever they choose to do so
- High Volatility
  - betting on the direction in which an asset's price will move
  - they are usually closed out prior to maturity and delivery usually never happens
    - a cash settlement usually takes place

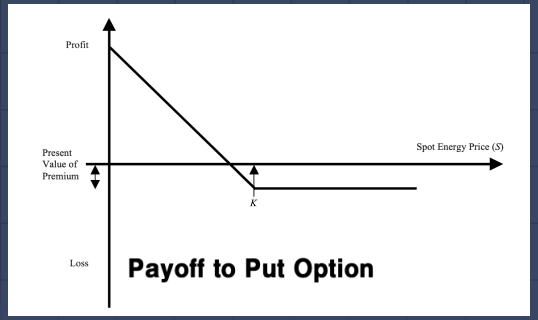
Example:

- Company A is afraid that demand will slow down and negatively affect the price of oil
  - The company initiates a futures contract to lock the oil price at $70 a barrel because they believe it will drop in six months.
- Oil prices have a few ways to move MTM Daily:
  1. If prices remain the same, there is no risk.
  2. If prices drop, Company A can still settle the contract on the original promised price of $70 per barrel.
  3. If prices rise, Company A loses out on the potential for any additional profit from the contract.

Trading: Derivatives- Options

An option gives the buyer the right, but not the obligation, to buy/sell an asset at a specific price at any time during the life of the contract



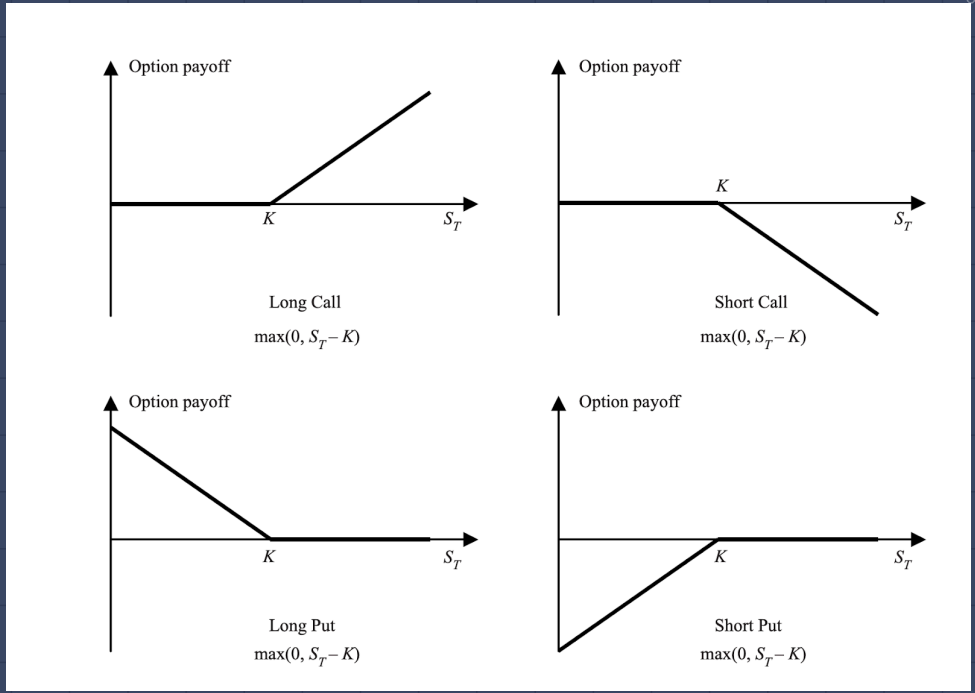


Terminology

- Long
  - a commitment to buy
    - benefits you if prices rise
- Short
  - a commitment to sell
    - benefits you if prices fall
- Call
  - gives holder the right to, but not the obligation, to buy the asset on or before a predetermined date at a specified price (strike price) which is agreed today
    - Payoff to a call option: max (0, S-K)
- Put
  - gives holder the right to, but not the obligation, to sell the asset on or before a predetermined date at a specified price (strike price = K) which is agreed today
    - Payoff to a put option: max (0, K-S), S= Spot Energy Price

Trading: Derivatives- Options

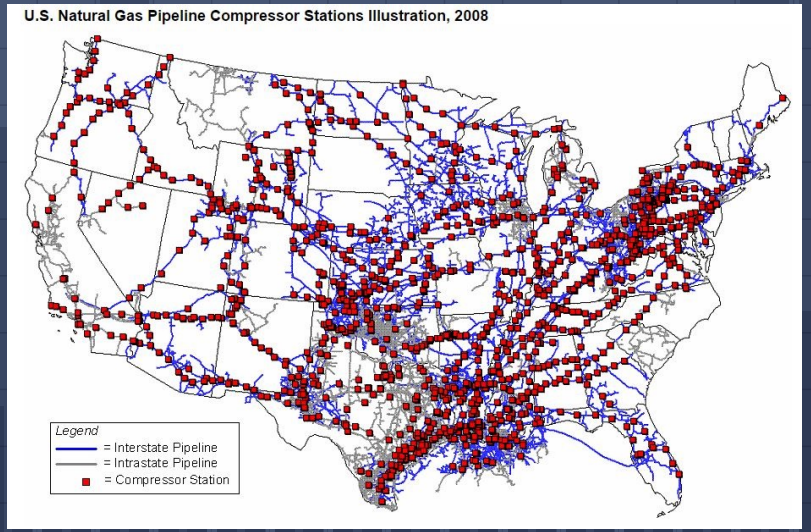
- At maturity date, for spot asset prices below strike price (K), holder lets option expire, and forfeits the premium paid to buy the option and buys asset at the spot market



At maturity date, for spot asset prices above strike price (K), holder exercises option (opposite of letting it expire), buys asset at K, and make a profit from difference of strike price and S

Scenario 1

- May 2005: NOAA(National Oceanic and Atmospheric Administration) predicts a 70% chance of an above-normal hurricane season, 20% chance of normal season, and a 10% chance of a below-normal season in the Gulf of Mexico
  - Gas is trading at a price of $6.50 MMBtu
- What position do you take?

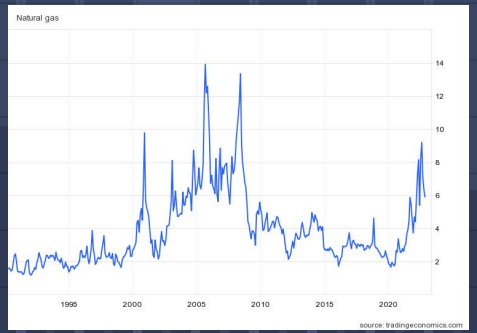


Scenario 1

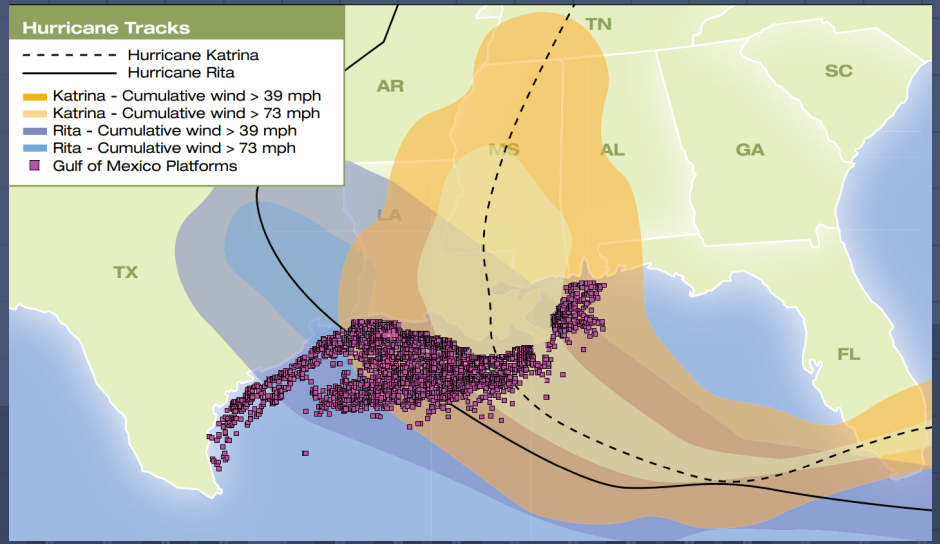
- August 2005: NOAA releases a new statement stating that there is a 95% chance of an above-normal hurricane season
    - Gas is trading at a price of $8.50 MMBtu
- Do you hold your position or change it?

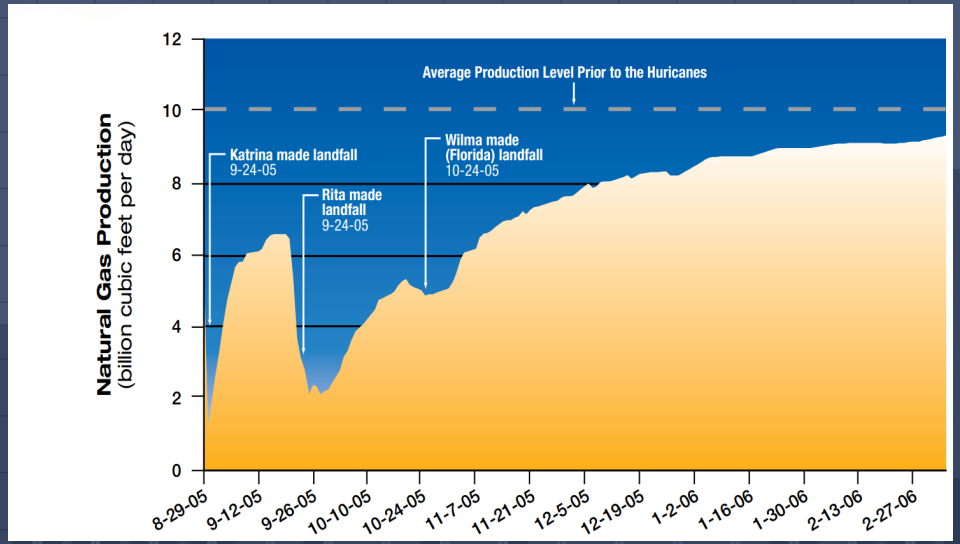
Scenario 1

- September 2005: Hurricanes Katrina and Rita strike the Gulf Coast, damaging natural gas infrastructure
- In 2005, the Gulf of Mexico produced ~20% of U.S. natural gas
- ~25% of oil and natural gas production shut down, and 8% of U.S. refining capacity went offline
- Due to limited supply and growing demand as winter approaches, natural gas prices skyrocketed, reaching almost $15 MMBtu
- NYMEX (NY Mercantile Exchange) declared a force majeure for all contracts with delivery dates in September and October
- Today, hurricanes have a diminished effect on natural gas prices due to the shale boom in the 2010s



Scenario 1


Hurricane Tracks
Hurricane Katrina
Hurricane Rita
Katrina - Cumulative wind > 39 mph
Katrina - Cumulative wind > 73 mph
Rita - Cumulative wind > 39 mph
Rita - Cumulative wind > 73 mph
Gulf of Mexico Platforms
TN
AR
SC
MS
AL
GA
LA
TX
FL

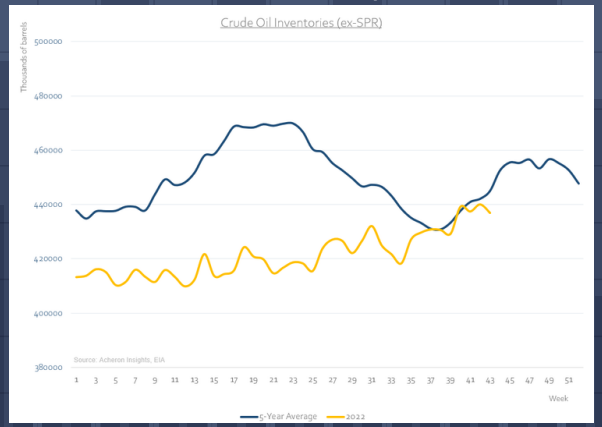

Natural Gas Production
(billion cubic feet per day)
12
10
8
6
4
2
0
Average Production Level Prior to the Huricanes
Katrina made landfall
9-24-05
Rita made
landfall
9-24-05
Wilma made
(Florida) landfall
10-24-05
8-29-05
9-12-05
9-26-05
10-10-05
10-24-05
11-7-05
11-21-05
12-5-05
12-19-05
1-2-06
1-16-06
1-30-06
2-13-06
2-27-06

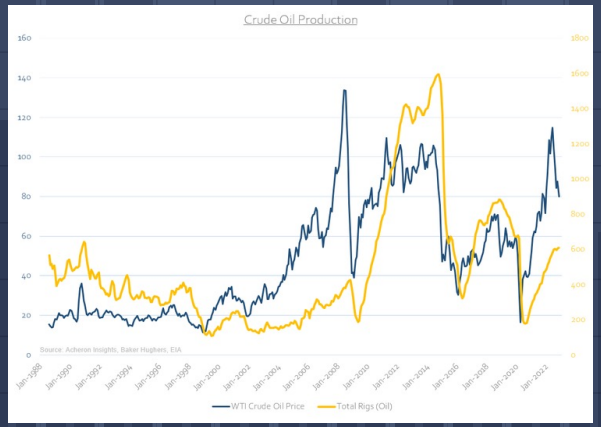
Scenario 2

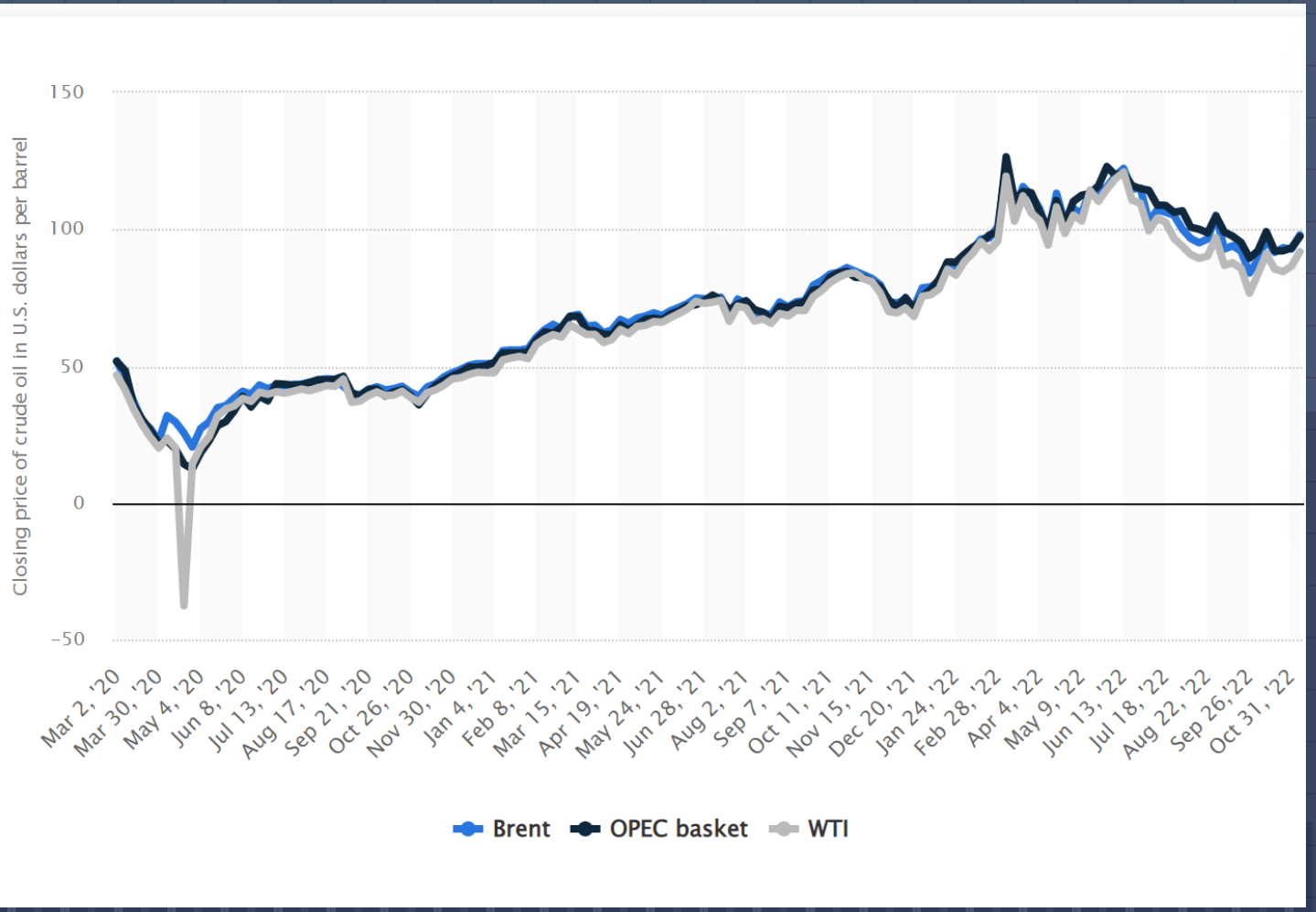
- Early this year, the US government has warned of an imminent war between Russia and Ukraine.
  - The scale of the war remains to be a question.
- February, the Biden administration assessed that Putin had made the decision to invade. While traveling in Lithuania, U.S. Defense Secretary said Russian forces were "uncoiling and now poised to strike". The scale is not small and people should take this very seriously.
- What's your position on this?
- April 20th, 2020 was the first day in history where oil recorded negative prices.
  - US oil benchmark West Texas Intermediate (WTI) fell from $17.85 at the start of the trading day to negative $37.63 by the close.
  - Oil and gas drilling global drilling activity reached a 20-year low with only around 55,350 drilled—the lowest level since at least the beginning of the century.
  - Even though 2021 drilling bounced back 12% and for 2022 the y-o-y growth is expected to be 19%, this number still felt short of 2019's.
- Midterm elections are at the end of this year and gas price is a major deciding factor

Scenario 2

- Supply is very strained with the war happening and sanctions being put on Russia
- Inventories offer the best possible insight into the current real-time demand for crude oil.
  - A significant build in inventories throughout September as Biden continued to drain the SPR, but still below their five-year seasonal average.
- With the midterm elections imminent and the motivation for Biden to further draw down the SPR to suppress energy prices perhaps ceasing => There will be upside when politicians no longer use such tools as a means to buy votes.

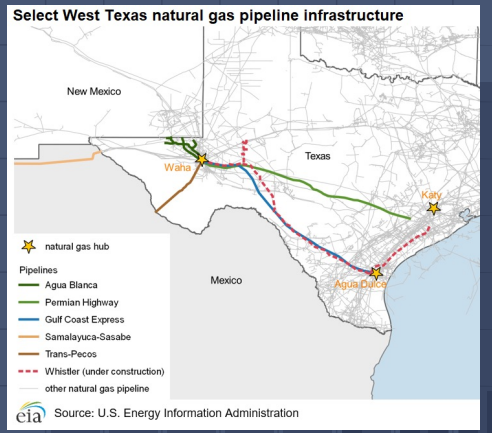





Closing price of crude oil in U.S. dollars per barrel
150
100
50
0
-50
Mar 2, '20
Mar 30, '20
May 4, '20
Jun 8, '20
Jul 13, '20
Aug 17, '20
Sep 21, '20
Oct 26, '20
Nov 30, '20
Jan 4, '21
Feb 8, '21
Mar 15, '21
Apr 19, '21
May 24, '21
Jun 28, '21
Aug 2, '21
Sep 7, '21
Oct 11, '21
Nov 15, '21
Dec 20, '21
Jan 24, '22
Feb 28, '22
Apr 4, '22
May 9, '22
Jun 13, '22
Jul 18, '22
Aug 22, '22
Sep 26, '22
Oct 31, '22
Brent
OPEC basket
WTI

Scenario 3

- You are a producer of crude located in the Permian Basin in West Texas, with natural gas as a co-product. You own approximately .65 billion cubic feet/day (650,000 MMBtu/day) of pipeline capacity on the Permian Highway Pipeline operated by Kinder Morgan.
  - Your daily production is ~0.5 bcf/day (500,000 MMBtu/day).
  - Runs from the Waha to Katy hub, where demand is higher.
- A midstream company, WhiteWater, is planning on constructing a pipeline.
  - This pipeline will generate an extra 2.6 bcf/day of takeaway capacity.
- Information:
  - You pay an average tariff of $0.25 /MMBtu
  - In the secondary market for capacity, the premium is $1.50/MMBtu
  - Katy traded price - $7.00 MMBtu
  - Waha traded price - $5.50 MMBtu
  - Your firm's meteorologist has informed you she believes there is a 60% chance of a storm taking out all capacity on a western bound pipeline with 2 bcf/day of capacity.
- What do you do?
  - Additionally, you have access to approximately 2 bcf of storage through your firm.



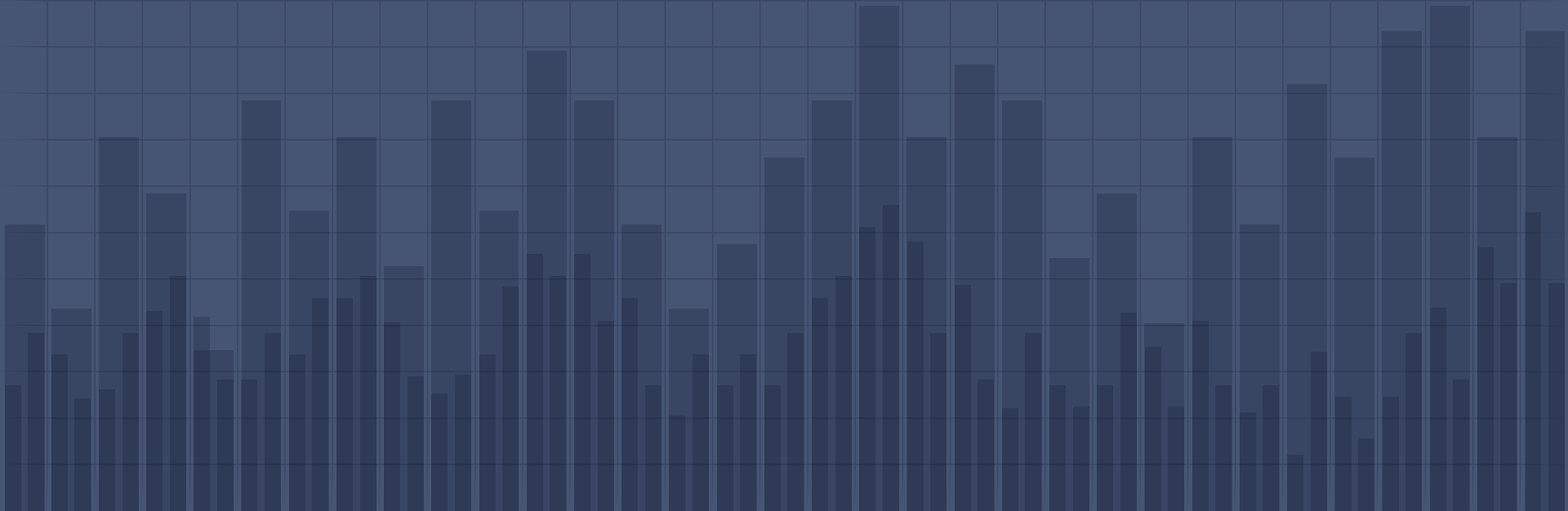
Scenario 3

- The storm your meteorologist warned you about ended up damaging parts of the westward pipeline. Now, there is not enough takeaway capacity from the Permian and prices have fallen. The operator of the out-of-commission pipeline expects repairs to take a week.
  - Katy traded hub has moved slightly down following warmer than expected weather, sitting at $6.55/MMBtu.
  - The premium on the permian highway capacity has skyrocketed. With Waha hub's traded price settling at $3.00, the premium now has settled at $3.55/MMBtu.
- Whitewater has reached a public Final Investment Decision after receiving bids on capacity to help gain debt-funding.
- What is your plan of action now?

Scenario 3

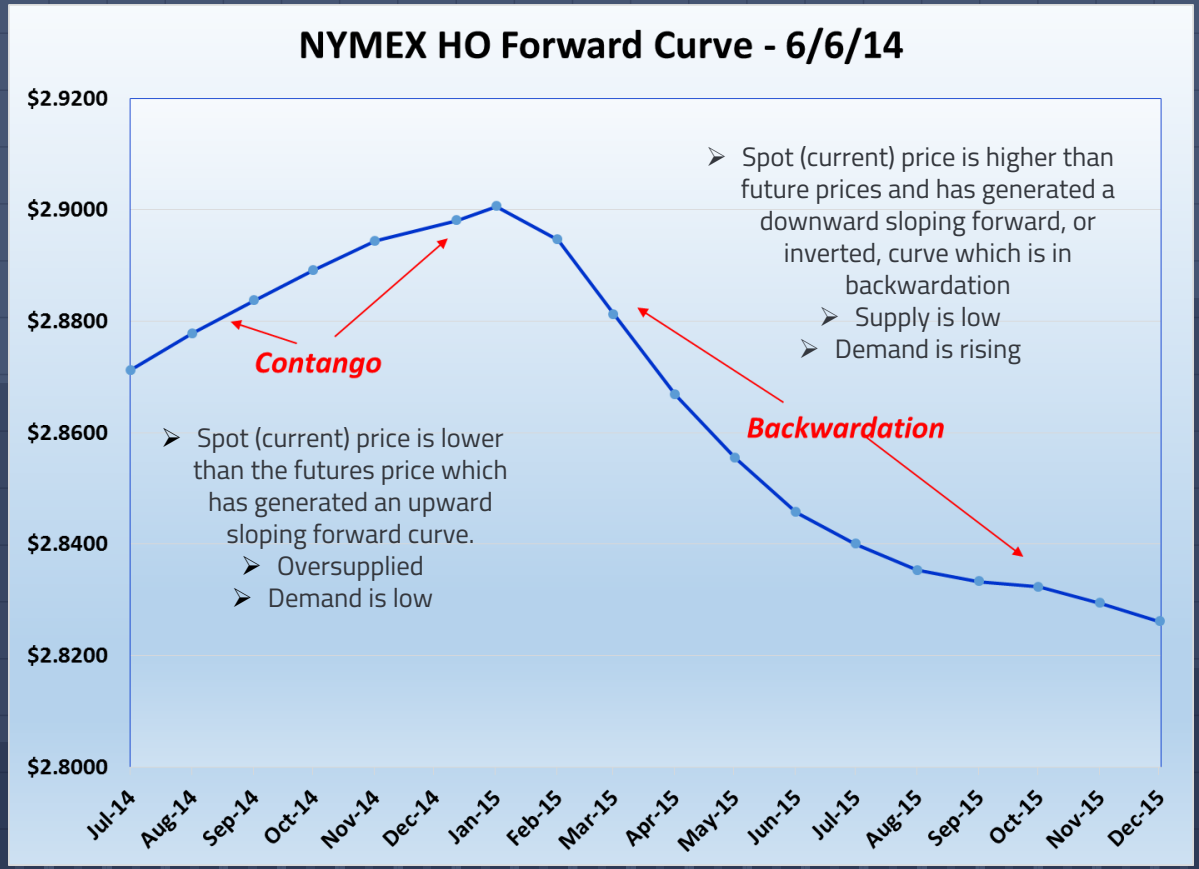
- The westward pipeline has completed repairs, and prices in the Permian have finally come back up, settling at $5.00/MMBtu.
- Katy traded has moved down even further to $5.50, and the tariff has thus fallen to $0.50/MMBtu.
- With several opportunities manifesting and vanishing, one key point can be taken away: **optionality matters.**
- Without optionality, you may get lucky and strike the most profitable deal, but nobody can correctly predict the future with limited information consistently. This means having a diversified portfolio with many options allows you to mitigate the downside while still achieving upside profit on a consistent basis.

Questions?



Appendix A:

- An array of forward prices for a certain market. Depending on the market, forward prices can change many times per hour, so a forward curve is always a snapshot of the market prices at a certain time.



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