

REFERENCE REPORT #31

ENERGY MARKETS GROW UP: HOW THE CHANGING BALANCE OF PARTICIPATION INFLUENCES OIL PRICE

On July 18, 2007, The National Petroleum Council (NPC) in approving its report, *Facing the Hard Truths about Energy*, also approved the making available of certain materials used in the study process, including detailed, specific subject matter papers prepared or used by the Task Groups and their Subgroups. These Topic Papers were working documents that were part of the analyses that led to development of the summary results presented in the report's Executive Summary and Chapters.

These Topic Papers represent the views and conclusions of the authors. The National Petroleum Council has not endorsed or approved the statements and conclusions contained in these documents but approved the publication of these materials as part of the study process.

The NPC believes that these papers will be of interest to the readers of the report and will help them better understand the results. These materials are being made available in the interest of transparency.

The attached Topic Paper is one of 38 such working document used in the study analyses. Also included is a roster of the Subgroup that developed or submitted this paper. Appendix E of the final NPC report provides a complete list of the 38 Topic Papers and an abstract for each. The printed final report volume contains a CD that includes pdf files of all papers. These papers also can be viewed and downloaded from the report section of the NPC website (www.npc.org).

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Energy Markets Grow Up: How the Changing Balance of Participation Influences Oil Price

- The most surprising thing about \$50+ per barrel oil prices isn't, arguably, the lofty nominal spot price per se, but very high deferred futures prices. It used to be that, ups and downs in the spot price ('flat price') aside, deferred futures prices always sloped towards a long-term average price of about \$20 per barrel. Now, as spot prices have climbed into new territory on a nominal basis, deferred futures, too, are well above the historically familiar range. The idea of mean reversion to a \$20-\$24 per barrel level is effectively no longer valid.
- In recent months, what had been a relatively flat backwardation throughout the crude curve turned into a steep upward slope, or contango, in the prompt six months. A survey of analysts two years back probably would have generated some scenarios in which outright prices broke old records, but few, if any, rationales for such a severe departure from the old paradigm that contango only occurs when prices are very low.
- So what changed? The contango at the front of the curve is the easy part to explain. We have in recent months seen a divergence between short- and longer-term fundamentals. Contango suggests wide availability of prompt supply, and recent inventory levels — particularly crude inventories, and particularly in the US — tell us more or less the same thing. Medium- to long-term fundamentals, meanwhile, do support the notion that oil prices will revert to a higher mean level going forward than they have in the past.
- But the argument that long-dated futures are high because oil will be expensive forever is a dicey assumption in a historically boom-bust market characterized by periods of over- and under-investment.
- More than anything it is the balance of buyers and sellers of financially traded energy that changed. Relative to more mature financial markets — such as interest rate derivatives, bonds, or equities — financial energy markets are young and dynamic. Physical supply/demand fundamentals still determine price in the long run, but the changing balance of market participation increasingly influences the price path. What could be called the 'paper supply/demand balance' — or, in other words, supply of and demand for deferred energy price — is increasingly relevant in this new market.
- In this report we explore who trades financial energy today, and how they participate in the market. The increase in the number of would-be buyers of energy over the past few years — including energy consumers, fundamentally-inspired speculators, and passive investors — coincided, as prices rose, with a marked decline in hedging by producers, the market's natural sellers. The result is a sharp increase in the competition for forward price that has changed the way the market responds to bullish energy fundamentals.

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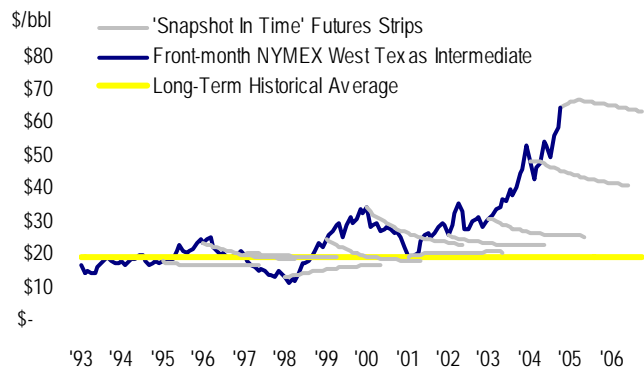
New York, September, 2005

What's Different About Today's Market?

The most surprising thing about \$50+ per barrel oil prices isn't, arguably, the lofty nominal price per se, but the fact that this two year rally has coincided with a remarkably flat futures curve or, in other words, very high deferred futures prices.

It used to be that, ups and downs in the spot price ('flat price') aside, deferred futures prices always sloped towards a long-term average price of about \$20 per barrel. In other other words when they spot price of oil was below \$20, the curve sloped up towards that level; when the spot price trended above roughly \$20, the futures curve sloped downward towards the historical average.¹ Now, as spot prices have climbed into new territory on a nominal basis, deferred futures, too, are well above the historically familiar range. The idea of mean reversion to a \$20-\$24 per barrel level is effectively no longer valid.

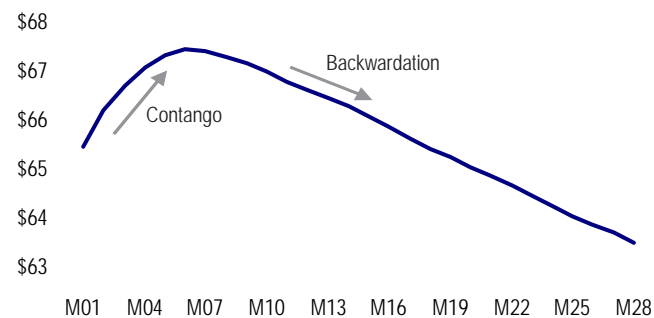
West Texas Intermediate Price History



Source: JPMorgan Energy Strategy.

In recent months, what had been a relatively flat backwardation turned into a steep upward slope, or contango, in the prompt six months of the crude curve:

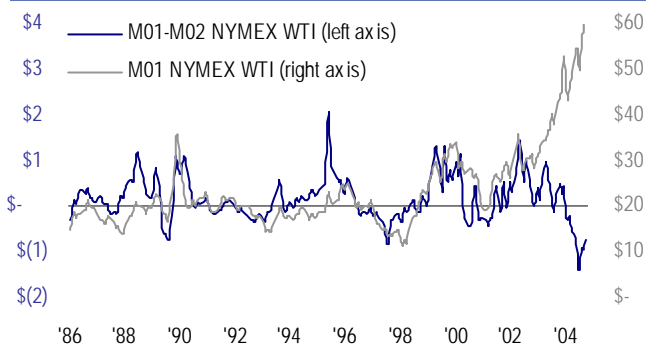
Today's West Texas intermediate Futures Curve



Source: JPMorgan Energy Strategy.

A survey of analysts two years back probably would have generated some scenarios in which outright prices broke old records, but few, if any, rationales for such a severe departure from the old paradigm that contango only occurs when prices are very low. When the slope of the forward curve first started to diverge from its traditional relationship with the flat price in early 2003, it looked like an anomaly — and a trade strategy. As the divergence has become wider and wider though, it is clear that something is different.

Forward Crude Spread Diverges From Flat Price



Source: JPMorgan Energy Strategy.

Expensive Forever?

So what changed? The contango at the front of the curve is the easy part to explain. We have in recent months seen a divergence between short- and longer-term fundamentals. Contango suggests wide availability of prompt supply, and recent inventory levels — particularly crude inventories, and particularly in the US — tell us more or less the same thing. In fact, the slope near the front of the oil futures curve has recently been more or less in line with what history would suggest at this inventory level.

Medium- to long-term fundamentals, meanwhile, do support the notion that oil prices will revert to a higher mean level going forward than they have in the past²:

- The world is running out of 'easy' production barrels.
- Oil demand — which grows incrementally even in periods of weak economic growth — is bolstered further now by the emergence of new economic powers that are in a more energy intensive stage of development than the mature economies of the US and Western Europe.
- Underinvestment in refining and distribution infrastructure has introduced bottlenecks to the supply chain that cannot be resolved overnight.

¹ In energy markets, a downward sloping futures curve — where prompt prices trade above deferred futures — is termed backwardation. Contango refers to an upward sloping futures curve, where deferred futures trade at a premium to spot prices.

² For a comprehensive assessment of the 'Long-term Fundamental Drivers of Oil and Gas Prices', please see August 2005 report from JPMorgan Energy Strategy, available on MorganMarkets.

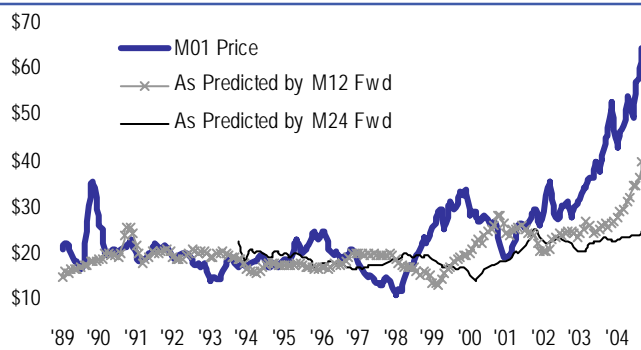
www.morganmarkets.com

- The industry holds structurally less inventory than it did ten, or certainly twenty years ago, which means that temporary disruptions can have a more acute market impact than they used to.

The problem is, these are all factors that — by and large — were known and discussed in the market long before deferred futures breached \$40, let alone \$60. The argument that long-dated futures are high because oil will be expensive forever is a dicey assumption in a historically boom-bust market characterized by periods of over- and under-investment.

Financial futures are not a predictor of future price, but rather the price at which a buyer of tomorrow's crude can find a seller of tomorrow's crude in the market today. In fact, oil futures have historically been a poor predictor of future price. The chart below shows the front-month oil futures price, alongside the price that the twelfth and twenty-fourth month futures would have predicted one, and two years prior respectively.

Oil Futures Don't Predict Future Oil Price



Source: JPMorgan Energy Strategy.

So what's different now? More than anything it is the balance of buyers and sellers of financially traded energy that changed.

Relative to more mature financial markets — such as interest rate derivatives, bonds, or equities — financial energy markets are young and dynamic. What used to be a market dominated primarily by energy producers and consumers is now increasingly influenced by pure financial players. Physical supply/demand fundamentals still determine price in the long run, but the changing balance of market participation increasingly influences the price path. While new entrants add liquidity to what are still relatively shallow markets, price distortions and exaggerations feature prominently in this rapidly developing playing field.

What could be called the 'paper supply/demand balance' — or, in other words, supply of and demand for deferred energy price — is increasingly relevant in this new market.

Who Trades Energy Today & Why

Producers & Consumers

Traditional participants in the financial energy trade — consumers, producers, and market-making financial institutions such as banks — are of course still present in the market, but have evolved since the inception of the energy futures trade. For starters, hedging has, in most circles, shaken off the 'gambling' stigma for the risk management label. In the corporate landscape hedging is now not only understood by shareholders but in many cases insisted upon. Derivatives strategies have become more sophisticated, and tenors longer as liquidity in deferred periods improves. A crude oil trade that might have met with decent liquidity five years out on the curve three to five years ago, for example, could now expect to find fair liquidity as much as 15 years out on the curve today.

The hedging behavior of energy producers and consumers is important because it determines, on both a macro and regional basis, the number of 'natural' longs or shorts in markets. Typically (as counter-intuitive as it may seem) we see producers hedge most actively in a weak price environment, and consumers move to lock in forward price in a strong market.

Why wouldn't a producer jump to lock in a \$60+/bbl price for the future, when the long-term historical average is close to \$20? Assume, for the sake of argument, that the historical cost of extracting the margin barrel of oil was \$18/bbl. With the market at, say \$25, a producer is close enough to its marginal cost of production to incentivize the purchase of downside price protection of cash flows. At \$60 — even if the marginal cost of production has increased — that pain threshold is much more distant. At the same time, many producers have a not so distant memory of locking in a price closer to \$40 when that seemed like a very attractive level.

Pressure from investors tends to mirror this tendency. In a bullish energy market, investors want reassurance that consumers have some protection from rising costs, but invest in energy producers for proxy exposure to upside energy price risk. Locking in future price eliminates that exposure, which is why both producers and consumers show a preference for hedging with options rather than swaps at today's price levels, to guarantee participation in a rally or retracement respectively.

We are beginning to see a shift in the producer paradigm, as some investors demand the monetization of future production at these high price levels. In addition, recent producer hedging activity in the wake of Hurricane Katrina suggests that the industry may view the \$70/bbl range as something of a ceiling, not least because that turns out to be the price level at which

Who Trades Energy Derivatives and Why?

Participant	Old or new?	Active or passive?	Buyers or sellers? Where on the curve?	Activity versus 3 years ago?
Energy Producers (E&P companies)	Old — Energy producers have been actively hedging with derivatives since the early-1990s	Active — May trade anywhere from daily to annually depending on hedging program	Sellers — The natural sellers in the energy markets. Producers typically hedge 2-3 years out but can now find sufficient liquidity to hedge as much as 7 years out.	Down — Significantly less day-to-day tactical hedging at high prices. Remaining deals large, occasional, one-off M&A related strategic hedges. Options strategies generally preferred over swaps, for downside protection with upside exposure.
Energy Consumers (Utilities, airlines, railroads, industrials)	Old — Energy consumers have been actively hedging with derivatives since the early-1990s	Active — May trade anywhere from daily to annually depending on hedging program	Buyers — The natural buyers in the energy markets. Consumers typically hedge 1-3 years into the future, but increasingly more sophisticated hedgers may go out as far as 5-7 years in products with sufficient liquidity.	Up — If anything consumers have hedged more actively as prices have risen, though options rather than swaps have been the preferred vehicle for upside protection with downside participation.
Financial institutions (Banks)	Old — Although the mix of banks in energy changes, banks have been market-makers and risk takers in energy since the inception of these markets	Active — Trade daily making markets (flow and structured business) and/or taking risk (proprietary trading). May have long or short term prop views	Buyers or sellers — Depending on customer business and view of the market. Depending on customer business, banks may make markets as far as 10+ years into the future.	No significant change, though interest has arguably increased with price.
Trend Players (Commodity Trading Advisors)	Old — CTAs have traded energy for years	Active — Fast moving, directional, tend to enter and exit positions quickly.	Buyers or sellers — Depending on market trend	No significant change.
Macro Hedge Funds	Old and new — Not new to energy per se but more professional and putting more money towards this space in the last ~3 years.	Active — Take proprietary risk daily. May have long or short term views, and take directional or relative value positions in the full range of energy products.	Buyers or sellers — Depending on view of the market. On average in recent years, hedge funds more long than short given price trend. Funds may participate in any part of the curve and have shown particular interest in owning deferred price and volatility, adding liquidity and price clarity to that part of the curve.	Up — Generally more dollars in energy, but also more sophisticated and varied involvement in full range of energy products.
Institutional Investors (Pension funds, mutual funds, retail investors)	New — Institutional investors have really only started to participate in the energy space in the past ~3 years.	Passive — Take long-term, generally directional views. Tend not to enter or exit positions on short-term price fluctuations	Buyers — Institutionals enter the market almost exclusively from the long side via products like Commodities Indices and oil-linked notes.	Up significantly — Major inflow of money and interest in commodities as an asset class that really did not exist in a meaningful way 3 years ago.

the US government and international community intervened to manage prices.

But by and large most of the producer business seen over the past couple of years has been associated with merger or acquisition activity, as opposed to pure tactical hedging. M&A related hedges have tended to be sizable, but one-off and occasional. As a result, the natural population of day-to-day sellers of deferred oil and gas price is automatically reduced.

Banks & Funds

Outside of producer and consumer risk management, there is a temptation to group all ‘speculative’ energy market participants together. In reality, these players are a varied bunch that we

would roughly define as financial institutions, commodity trading advisors (CTAs) or ‘black box’ traders, macro hedge funds, and institutional investors.

Banks as a group are not new to the energy space. They have historically been the market makers in the energy trade, and may also warehouse risk in short- or long-term proprietary trading positions. In either of these roles, banks may be long or short the market depending on client flow and house views.

CTAs, too, have been active in the energy trade for some time, and may also be long or short. CTAs can, however, move in and out of positions very quickly and tend to trade purely technically, or mathematically, as opposed to fundamentally.

Macro hedge funds are not new to the energy space per se, though their presence has certainly increased and with it the hype surrounding their role in the market. Hedge funds are not only allocating more money to energy now, but as a group have also become significantly more sophisticated in terms of the type of trading they do. By hiring career energy traders in many cases, hedge funds increasingly trade a fundamental view in lieu of or in addition to a technical model. Increasingly sophisticated relative value trading supplements directional strategies, and positions are taken further and further out on the futures curve. Hedge funds have not only added significant liquidity to the back of the oil curve, but also definition — more active trading of deferred futures has added price clarity to a part of the curve that used to be much more murky.

While hedge funds may be either long or short depending on their view of opportunities in the market, they have probably been more long than short over the past two years in line with a compelling market trend and broadly supportive fundamental energy story. Virtually all the acute, event-driven shocks that one can imagine waking up to one morning with no advance warning would increase energy prices, not lower them, and this has not been lost on the speculative community.

Institutional Investors

Institutional investors — a group distinct from other, more active financial participants — are the newest entrants to the energy space, and possibly the most poorly understood. During a period of low interest rates and relatively few opportunities in traditional investment arenas, the notion of commodities as an asset class and vehicle for portfolio diversification has caught on, aided by a supportive fundamental bull story that has become prominent even in the mainstream media. This group includes pension funds, mutual funds, and even retail investors who may have a broad, macro view of the sector but little expertise in the intricacies of these markets.

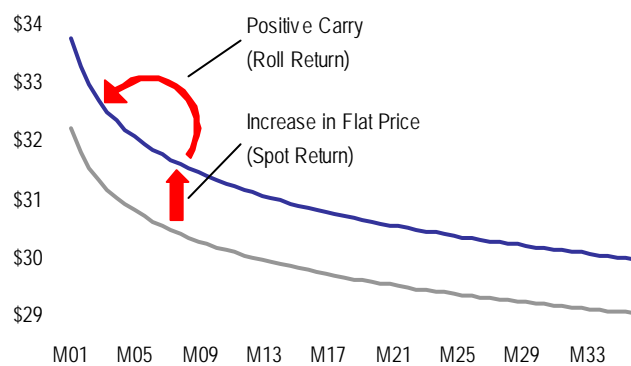
Investor products, such as commodity indices and commodity-linked notes give the non-expert an opportunity to add commodity exposure to a diversified portfolio.

The indices, such as the Goldman Sachs Commodities Index® and the Dow Jones AIG IndexSM, are long-only baskets of commodities and have been the most popular product for passive participation in the commodities space. The ratio of commodities in the basket is set for branded index products — the DJ-AIG Index, for example, includes roughly equal weightings for energy, metals, and agricultural products, whereas the GSCI weights the energy component more heavily. An investor may express a view on one or more commodity

groups by customizing a similar structured index-style product that favors or excludes certain commodities.

In any case, length in branded index products is held in the second or third month futures contracts, and rolled every month or every second month as those contracts approach maturity. In this way, an index position could, under the proper circumstances, make money in two ways: a ‘spot return’ is earned when the outright prices of the underlying commodities go up, and a ‘roll return’ is earned when the futures curves of the underlying commodities are downward sloping. In other words, if the second or third month future price — the entry level — is lower than the prompt price — which is effectively sold during roll periods — then an index position earns positive carry as length literally rolls up the curve. For this reason, the total return on an index position could be positive even if one of the components of that return — the spot return or the roll return — is flat or negative.

Indices Can Pay Two Ways In a Backwardated Market



Source: JPMorgan Energy Strategy.

Over the past couple of years, commodity indices have been tremendous performers as spot prices of most major commodities rallied while — until recently at least — several major index components were in steep backwardation.³

Institutional investors participate in the energy trade exclusively from the long side, and exclusively over-the-counter, making their influence hard to quantify. Most estimates see as much as \$55-\$60 billion in passive commodity investment products today, relative to less than \$10 billion three years ago — not a lot of money for deeper and more mature financial markets, but a sizable and sudden influx for energy markets.

Most institutional investors in commodities view the allocation as a long term one. Major pension funds have allocated anywhere from 2-5% of their portfolios to commodities in recent years — not a huge portion of their total investments, but a significant addition to what are still relatively shallow markets.

³ For a complete analysis of index returns, please see JPMorgan's monthly Commodity Markets Outlook & Strategy, available on MorganMarkets.

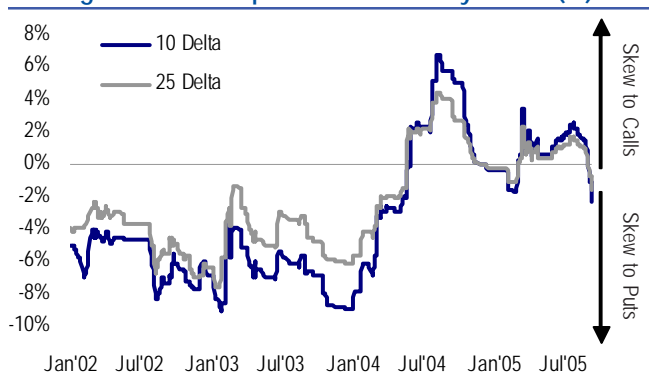
Quantifying ‘Speculation’

It is tough to put a dollar value on the outright contribution of ‘speculation’ to oil or other commodity prices. While we can make back-of-the-envelope estimates of how much investment money has entered the market in this form, there is no hard data on these flows. Commitment of Traders data from the Commodity Futures Trading Commission (CFTC) gives good clues as to how traders are positioned in energy markets, this data has limitations. For starters, CFTC data reflect only exchange trade, and not over-the-counter-trade.

But certain market distortions do highlight concrete ways in which the change in the balance of energy market participation — in the investor community as well as the traditional consumer/producer community — has influenced the trade.

The volatility skew for West Texas Intermediate — which effectively shows the relative cost of puts and calls struck at equal deltas — also illustrates how the market has changed recently. Typically, crude volatility is skewed towards the put side — i.e. puts are relatively more expensive than calls — reflecting the traditional dominance of producer hedging. In the past two years or so, the skew has shifted more often to the call side, reflecting the marked increase in the number of market participants willing to pay a premium to reserve the right to buy oil at a certain price, relative to the number of participants looking to reserve the right to sell. While the skew has on occasion shifted back to the put side during large producer deals, such as M&A related hedging programs, by and large the buyers have been the dominant presence in this market.

Rolling 12-Month Implied WTI Volatility Skew (%)



Source: JPMorgan Energy Strategy.

The front of the oil curve, in particular, has become saturated with index-style investment dollars. With index length held in the second or third month futures contracts, and rolled every month or every other month during a designated and well flagged roll period, we have seen for over a year — even when most of the oil curve was still in consistent backwardation — pressure on the very front of the curve during these periods.

Now that the oil curve is in a more consistent contango — partly attributable to weak short-term fundamentals — the roll yield that had for some time contributed to positive index returns has disappeared. While spot returns, and thus total returns, have still been relatively good on these investor products, the shape of the curve today suggests that passive investors will have to adjust their expectations or find new ways to gain exposure to commodities going forward.

Pointing Fingers

The negative connotation of ‘speculation’ — often implied to have no grounding in a fundamental view of the market — makes financial participants in the trade easy scapegoats for uncomfortably high prices. But energy speculators are attracted to this market by a perceived opportunity in response to a compelling fundamental story. The story came to the fore in early 2003, when military action in Iraq came hot on the heels of crippling strikes in Nigeria and Venezuela, and has gained significant mainstream traction as refinery capacity constraints, robust Chinese demand growth, and debates over Saudi reserves draw media attention. The proliferation of investor products offered by banks and other financial institutions offer vehicles for passive participation in this story.

“There were more buyers than sellers out there today,” traders offer as a tongue-in-cheek explanation for a price rally. Though clearly it is the availability of a seller that makes a buyer a buyer, the cliché in a sense does help explain the persistent support for deferred futures prices. The increase in the number of would-be buyers of energy over the past few years — including energy consumers, fundamentally-inspired speculators, and passive investors — coincided, as prices rose, with a marked decline in hedging by producers, the market’s natural sellers. The result is a sharp increase in the competition for forward price that has changed the way the market responds to supportive energy fundamentals.