

Landfill Gas to Energy Projects:
A Developer's Perspective
with Implications for the Landfill Owner

December 2007

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Overview

DTE Biomass Energy

Landfill Gas to Energy Project Development

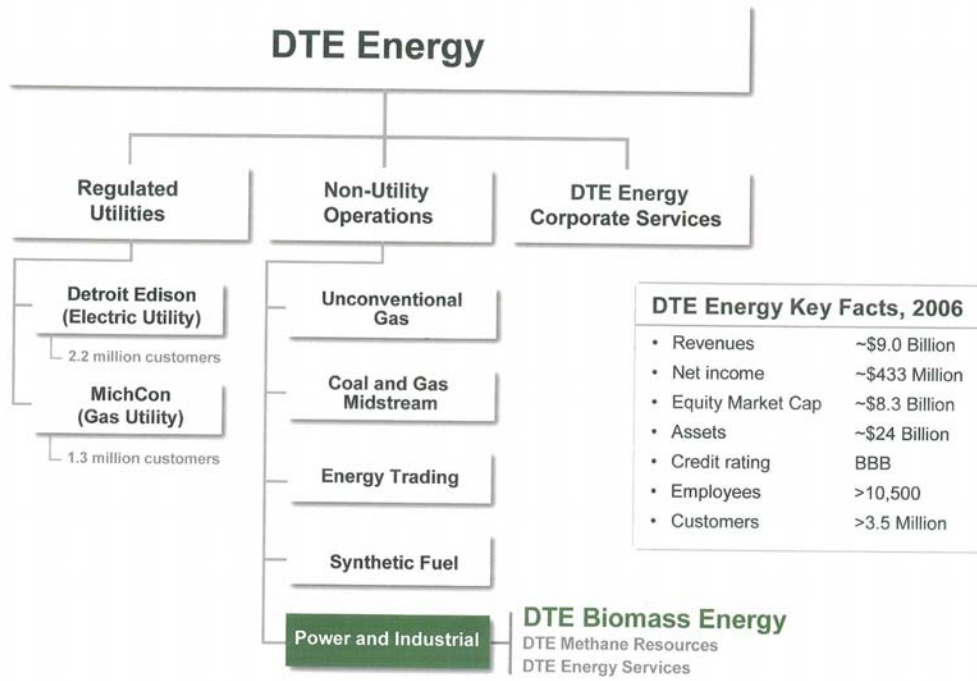
Developing Projects with Landfill Owners

Power and Gas Markets

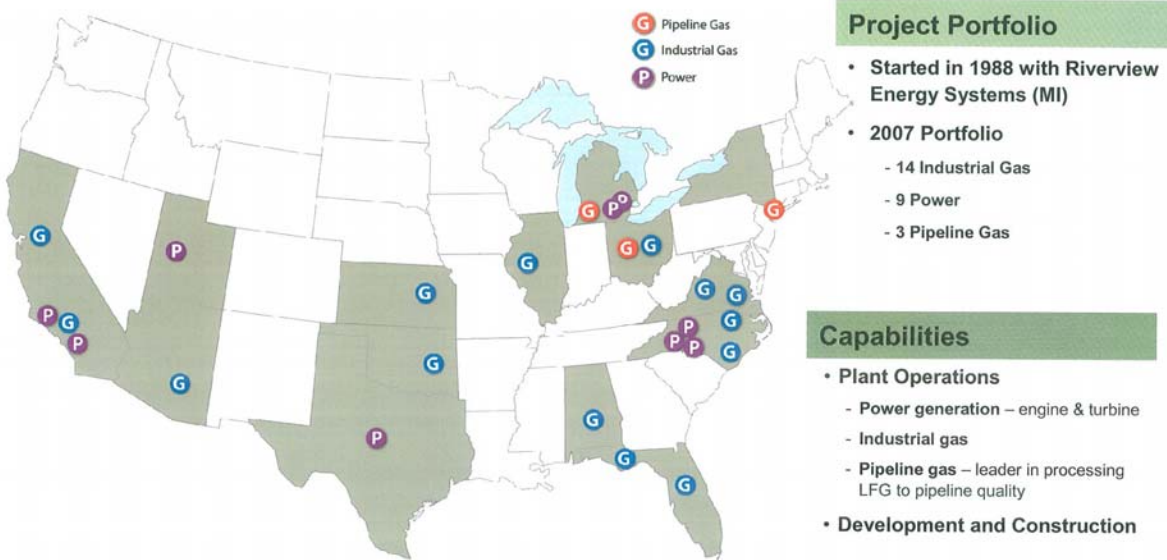
Questions

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Who is DTE Biomass Energy?



DTE Biomass Energy, Inc.



Overview

DTE Biomass Energy

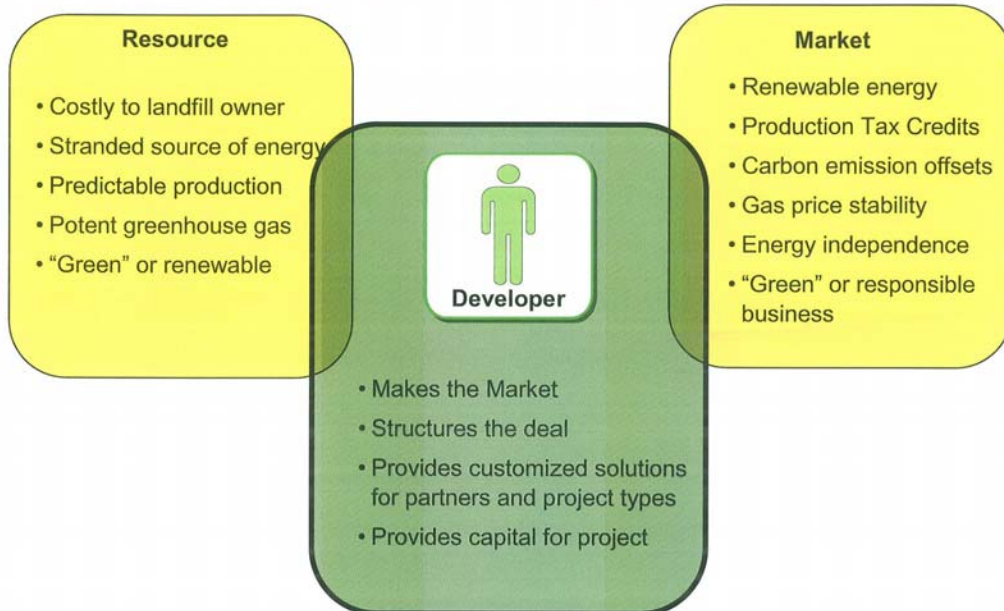
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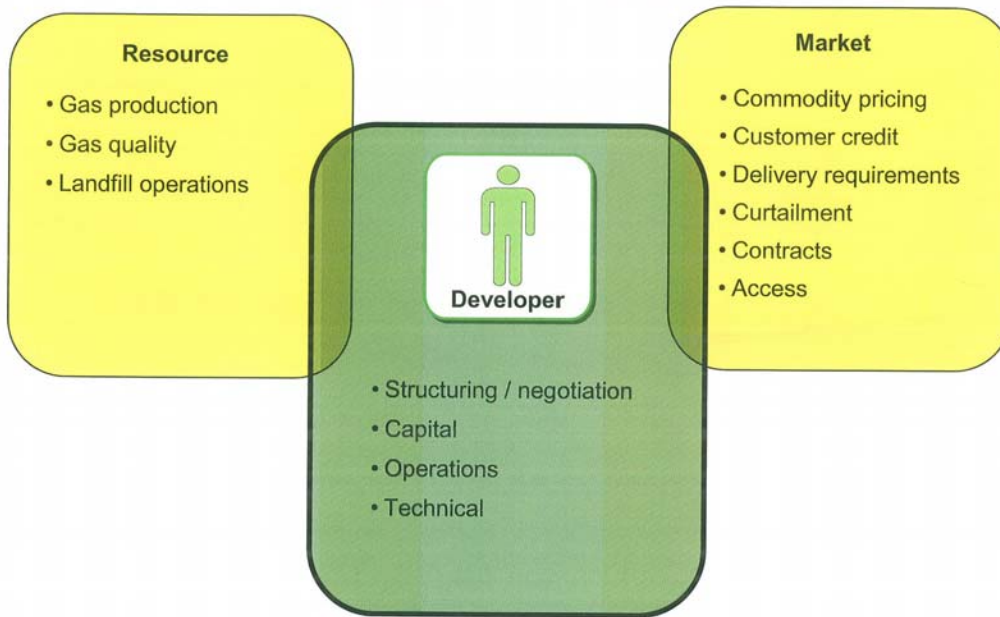
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Landfill Gas to Energy: Opportunities



Developers can create significant value by bringing landfill gas to market...

Landfill Gas to Energy: Risks



...however, placing large capital bets in the face of changing energy markets requires financial and operational discipline

Landfill Gas Project Types

Power (Electric Generation)

- Over 70% of LFGTE projects in the U.S.
- More efficient to transport electrons than gas
- Proven technology
- **Wholesale power pricing and REC markets key determinant in project feasibility**



Industrial (Medium-Btu)

- Minimal processing required and minor modifications to customers plant
- Substantial capital investment in pipeline/plant
- Customer service essential for success
- **Pipeline distance and fuel offset critical in project feasibility**



Landfill Gas Project Types

Pipeline (High-Btu)

- High capital and operating costs
- "infinite" number of customers once connected
- **Quantity and quality of landfill gas critical determinant of project feasibility**
- **Distance to NG pipeline and delivery pressure key determinants of project feasibility**



Compressed/Liquefied Natural Gas (CNG/LNG)

- *Same characteristics as the pipeline project*
- Additional capital and operating costs, but similar revenues
- **Government support is key driver of project feasibility**



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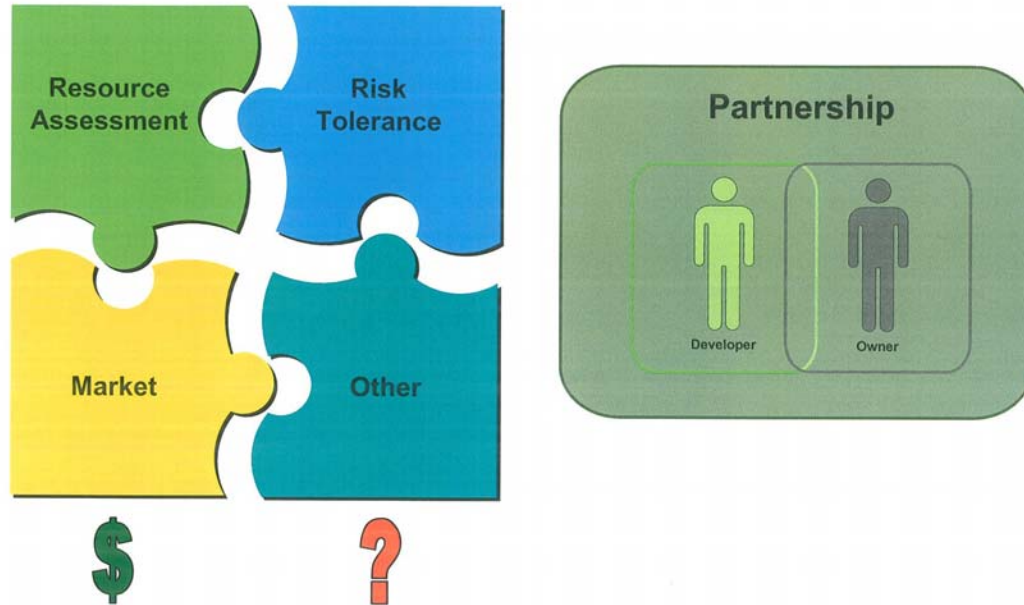
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Evaluating and Structuring a Project



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Step 1: Resource Assessment



Gas Volumes

- Actual gas production
- GCCS buildout
- Waste intake
- Landfill operations

Gas Quality

- Collection system operation

Energy Infrastructure

(plants, pipelines, powerlines)

- Availability/Access
- Distance



Gas Volumes

- Expected gas usage
- Excess gas availability

Gas Quality

- Project vs. compliance
- Minimum specs
- Self help

Contractual Provisions

- Wellfield construction and operations
- Gas Sales vs. Gas Rights
- Termination and site lease

While developers will strive for flexibility, owners will need assurance around compliance and maximum gas usage

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Step 2: Market Assessment



Commodity Markets

- Regional power markets
- Gas and coal markets
- Renewables (RPS → REC's)

Customer Requirements

- Fuel switching
- Energy demand
- Capital investment

Additional Incentives

- Production Tax Credits
- Carbon emissions offsets
- Voluntary "green" premiums



Royalties

- Owner shares in project success
- Level tied to project economics
- Structures can be devised to address "windfalls" in pricing

Project Considerations

- Size, type, and growth of project
- Investments by other partners

Additional Incentives

- Important to address anticipated and unknown incentives
- Sharing tied to partner investment

As the economics of a LFGTE improve, more value will be delivered to owners through royalties and revenue sharing structures

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Step 3: Risk Assessment



Execution

- Construction
- Interconnect
- Permits
- Energy Contracts

Gas Production

Commodity Price Risk

Operations



Project Risk

- Determined by level of investment made by owner
- Project Fails → no revenues, delay with new developer

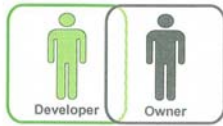
Royalty Risk

- Owner shares in commodity and production risk
- Incentives to maximize gas production and beneficial use
- Hedging can reduce risk but at a cost

Typically the developer bears most of the risk in LFGTE projects and will require higher returns to pay back capital

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Step 4: Other Considerations



Capital

- Project financing
- Owner participation

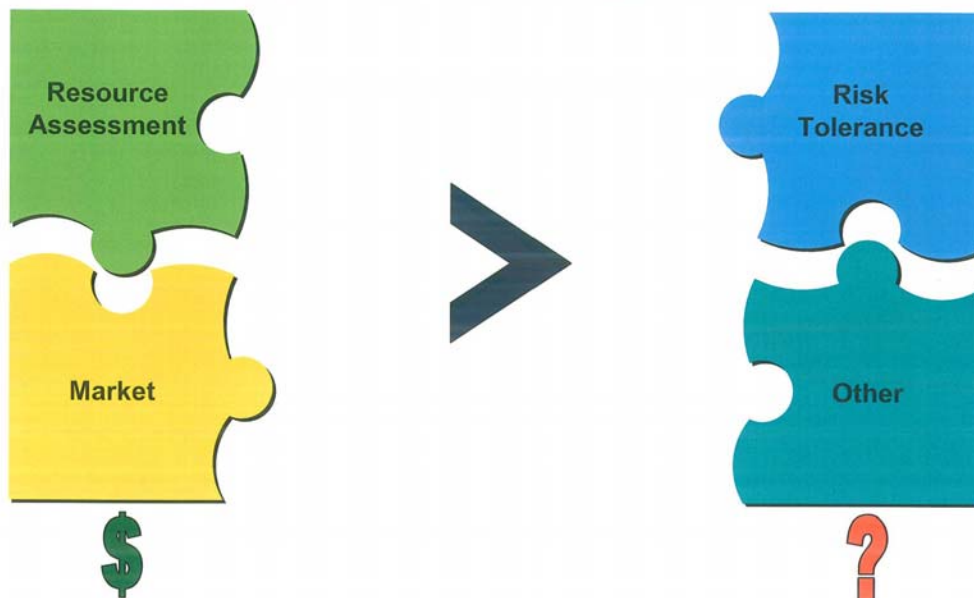
Political

- Local energy needs
- Owner participation

Owner Specific

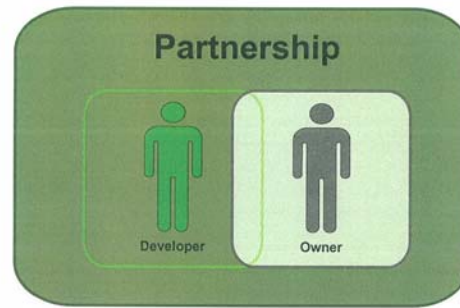
Other factors can influence the development of a project and must be considered between the developer and landfill owners

Risks and Returns



Projects are feasible when the returns are commensurate with the risks associated with the project

Establishing a Strong Partnership

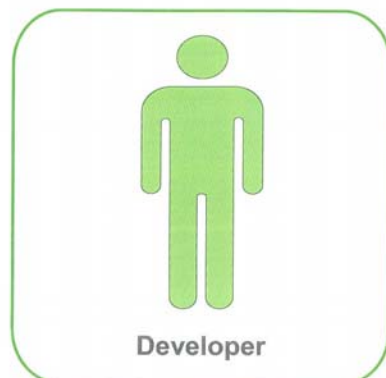


A strong partnership is achieved when:

- Incentives are aligned
- Each party understands the risks of the other
- Returns are aligned with those risks
- Respective parties deliver on their commitments

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Developer Capabilities



Experience

- Development
- Operating
- Energy

Success

- Longevity
- Profitability

Owner-Operator

Financial Strength

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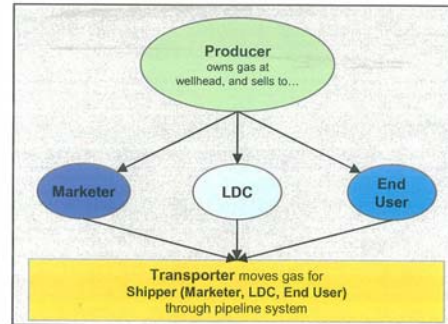
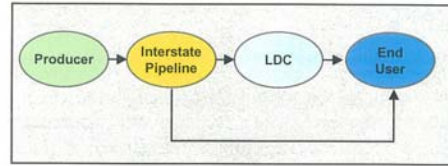
The Natural Gas Industry – Markets

- Natural gas is sold as a commodity, much like corn, copper, oil and pork bellies
 - The basic characteristic of a commodity is that it is essentially the same product no matter where it is located
- Commodity markets are inherently volatile, meaning the price of commodities can change often, and at times drastically
 - Natural gas is on of the most volatile commodities on the market
- Natural gas is priced and traded at many locations throughout the U.S. and Canada
 - The principle hub is the Henry Hub in Louisiana at which NYMEX futures contracts are traded
- Futures markets exist to transfer price risk from industry participants (“Commercials”) to price speculators
- There are two objectives to trading in financial gas markets: hedging and speculation



The Natural Gas Industry – Regulatory Framework

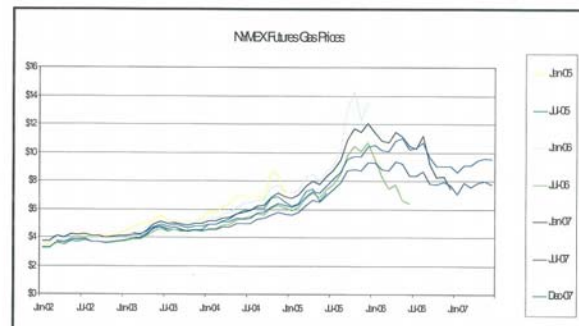
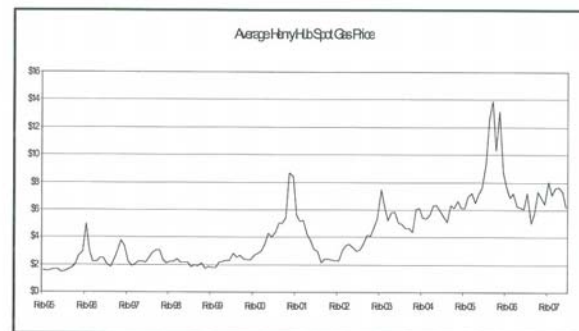
- **Prior to deregulation and pipeline unbundling**
 - Limited flexibility with few options for gas delivery
 - Producers sold to pipelines who sold to LDC's, who sold to end user customers
 - Federal government regulated wellhead prices
 - State government monitored the price LDC's could sell to customers
 - Little competition or incentive to improve services
 - Led to supply shortages in the 1970's and surpluses in the 1980's
- **After pipeline unbundling**
 - Markets are open to competition and choice
 - Wellhead prices are determined by supply and demand interactions
 - Pipelines no longer are merchants
 - LDC's continue to provide a bundled delivery service with open access transportation also available
 - Marketers act as facilitators between buyers and sellers
 - Ensuring a liquid, transparent market exists for natural gas
 - Often including the intermediate steps that a purchase requires such as arranging for transportation and storage and accounting



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The Natural Gas Industry – Price Volatility

- The North American natural gas markets have moved from one which had slack supply available to meet demand spikes to one in which there is little excess supply
- The tight supply and demand balance has resulted in increased price volatility both in daily spot gas prices and in the futures market
- Also contributing to the increased price volatility is the growth in non-commercial trading activity, or speculators betting on the future direction of gas prices
- Like all commodity markets, the inherent volatility of the price of natural gas requires the use of financial derivatives to hedge against the risk of sharp price movements
 - Buyers and sellers of natural gas hedge using derivatives to reduce price risk
 - Speculators assume greater risk in order to profit off of changes in the price of natural gas



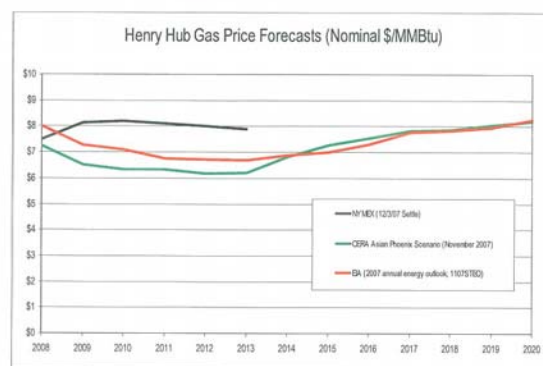
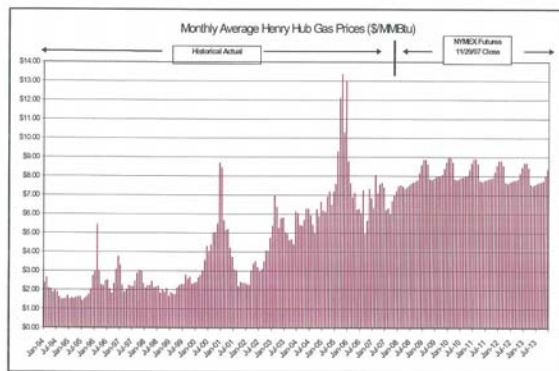
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The Natural Gas Industry – Marketing and Trading

- There are two distinct markets for natural gas
 - The **spot market** (physical) is the daily market where quantities of natural gas are bought and sold on a daily basis
 - Physical trading contracts are negotiated between buyers and sellers and include many standard terms and conditions
 - The daily spot market is active and trading can occur 24 hours a day seven days a week
 - The largest volume of trading occurs in the last week of every month, known as “bid week” when producers and consumers try to meet their needs for the following month
 - The **futures market** (financial) consists of buying and selling natural gas under contract at least one month, and up to 72 months in advance
 - Futures contracts are but one of a number of derivatives contracts used in commodities markets and can be quite complex and difficult to understand
 - Derivatives contracts are traded either in the over-the-counter market or on an exchange such as NYMEX or ICE
 - Trading financial derivatives can help mitigate or “hedge” price risk
 - Financial gas markets are also used by participants that want to speculate about future price movements and take on additional risk in hope of a higher return
 - Financial speculators need not have any vested interest in the buying or selling of the physical natural gas itself, only in the inherent underlying value represented in the financial derivatives
 - It is estimated that the value of trading that occurs on the financial market is 10 to 12 times greater than the value of physical gas trading

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The Natural Gas Industry – Marketing and Trading



- Is the NYMEX futures curve an accurate prediction of physical spot gas prices?
- When compared to fundamental market-based forecasts, the NYMEX curve includes a risk premium associated with short and long-term market uncertainties
 - Short-term: weather; supply disruptions; storage inventory levels
 - Long-term: domestic production declines / growth; pipeline and storage infrastructure additions; LNG supply growth; economic growth; oil prices
- Spot Market prices will be set by real-time market conditions and studies indicate the prices of natural gas futures contracts do not perform well as a predictor of realized spot prices

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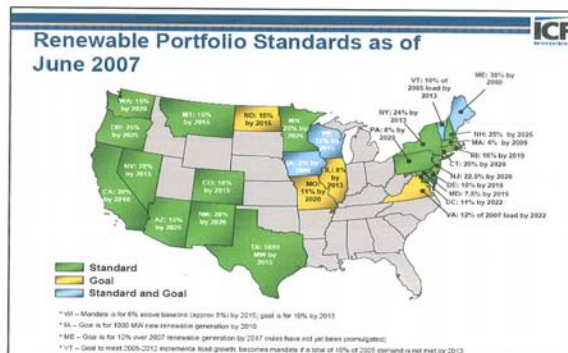
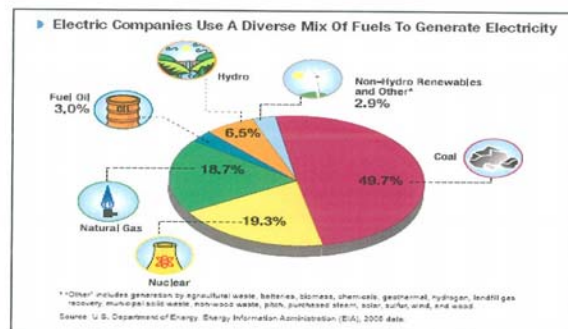
The Natural Gas Industry – Marketing and Trading

- Commonly used price hedging tools
 - **Gas Futures:** gas commodity forward contracts
 - **Call Options:** gives the buyer the right, but not the obligation, to buy gas at a specified price during a specified period of time
 - **Put Option:** gives the buyer the right, but not the obligation, to sell gas at a specified price during a specified period of time
 - **Costless Collars:** a combination of puts and calls with equal premiums that produces a ceiling and floor price range
 - **Basis Hedge or Basis Swap:** to hedge against price differential changes between the Henry Hub and another market hub
- Derivatives
 - **Forward Contract:** the sale of a promise solely to deliver future assets
 - **Futures Contract:** the sale of a promise to either deliver or pay the cash value of future assets
 - **Contract for Differences:** the sale of a promise today solely to pay the cash value of future assets
 - **Option:** the right to think about purchasing a promise at an agreed price
 - **Swap:** when a party decides the promise of future owned assets is not as desirable as another, the party may trade the promise it owns for the one it wants, making a “swap”

Participation in the forward gas market requires a high level of industry saviness and there are significant costs of entry

Power Market Influences

- Natural gas prices influence and often set the marginal cost of electricity in many markets
 - Over 200 GW of gas-fired power generation has been installed in the U.S. since the late 1990's
 - As the economy grows and demand for electricity increases, gas-fired generation is increasingly used as other fuel sources have limited spare capacity
 - The increased gas demand for power generation has influenced gas prices
- Renewable Portfolio Standards (RPS)
 - State program targets if fully realized would result in lower energy prices by 2020
 - However some states are already having difficulty meeting immediate targets
 - Gas will likely serve intermediate needs
- GHG / CO2 exposure
 - Increasing probability of CO2 tax implementation affects energy prices and capacity expansion options
 - \$1/ton has roughly \$1/MWh impact, with significant impacts on new coal, renewable and nuclear plant economics



Key Takeaways

- The natural gas and power markets have evolved into highly sophisticated markets with many short and long-term drivers
 - Power markets are increasingly influenced by natural gas prices as gas is “on the margin” in many markets
- While the trading in futures contracts provides benefits to market participants by provided some degree of market transparency and liquidity, futures prices do not perform well as a predictor of Henry Hub spot prices
- As the supply and demand balance in natural gas markets is increasingly tight, gas prices exhibit significant changes in absolute values and volatility
- Looking ahead with natural gas markets becoming global, there is high probability that volatility will continue
- A strong partnership between owners and developers can mitigate risk and bring project benefits to both parties

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