Managing Transportation and Storage Risks

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Overview

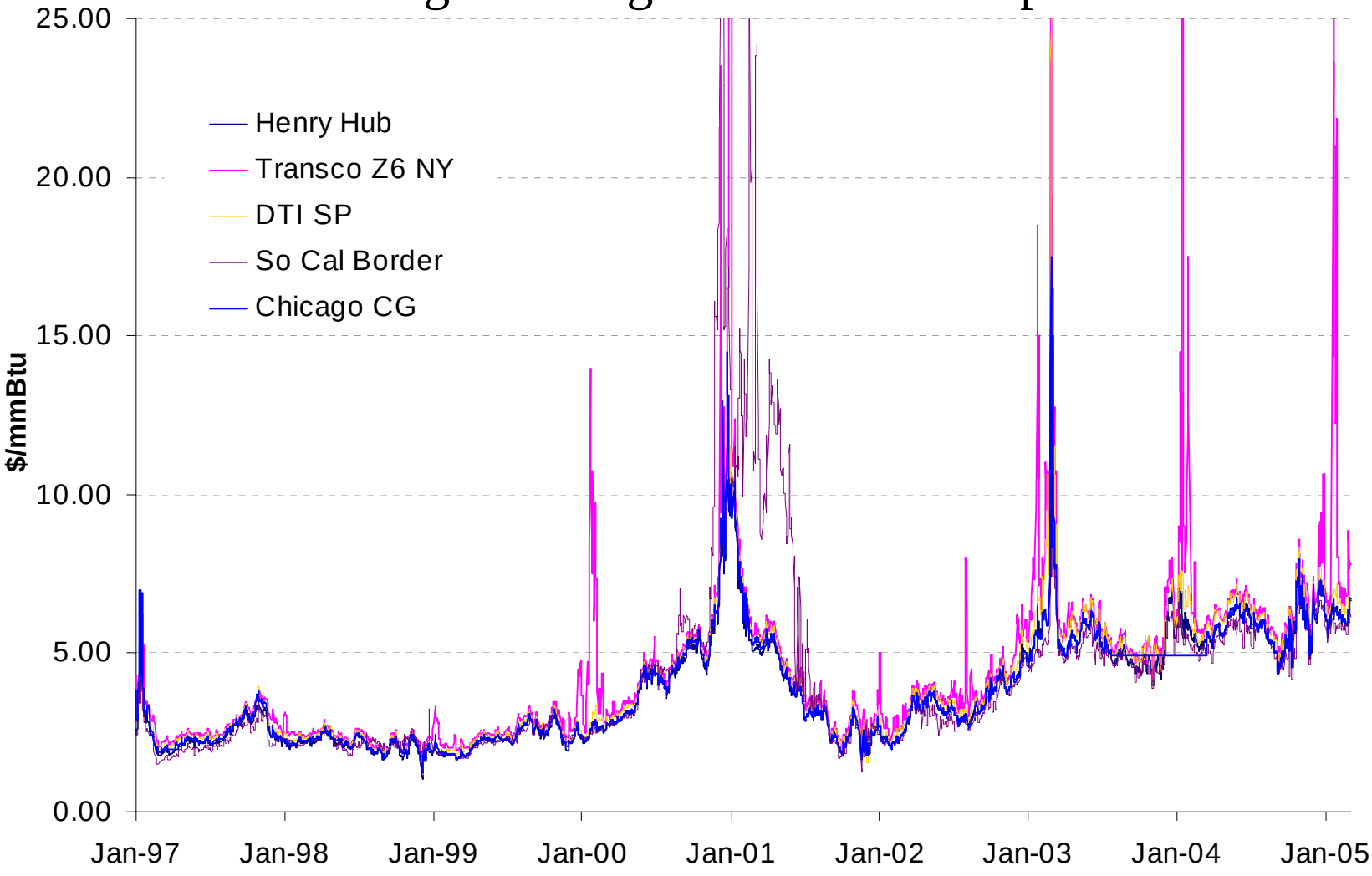
- Focus on natural gas transportation and storage contracting issues
- Market fundamentals/background - gas prices
- Pipeline transportation & storage trends
  - Market dynamics
  - Contracting issues and risks
  - Valuation of service
  - Mitigation options: risk vs. cost

Market Fundamentals – Gas Prices

- Price risk affects contract decisions along the entire supply chain
- Increased frequency of “supply squeezes”, i.e., seasonal and daily Price Volatility
  - Production: treadmill effect
  - Storage constraints
  - Pipeline congestion
- Industrial demand destruction
- Transition from a continental to a world market w/ increased reliance on imported LNG

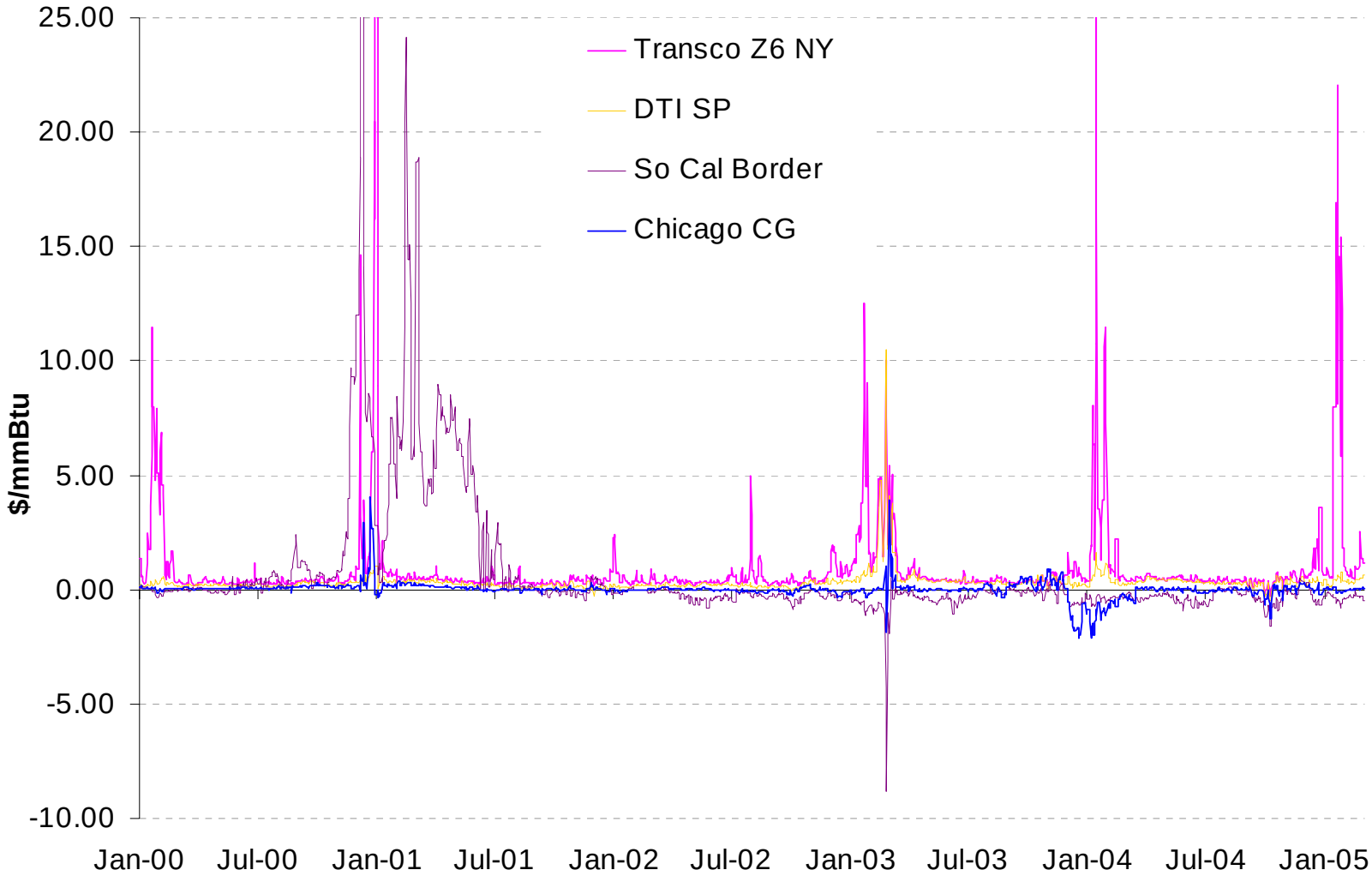
Market Fundamentals – Gas Prices

The 2000-2005 period reflects current pricing dynamics, after gas-fired generation build-up



Market Fundamentals – Basis Spreads

- Highly volatile & seasonal, especially in Northeast



Emerging Pipeline & Storage Trends

- Values driven by seasonal and locational (basis) price spreads
- Increased use of alternatives to traditional FT from production area
  - Trend toward reliance on FT only back to the nearest liquid price point
- Rapid development of high deliverability storage (HDS)
- Commodity and basis volatility defines opportunities and risks

Pipeline Transportation Dynamics

- Market dynamics result in increased pipeline load factors
- New transport pathways
- “Degradation” of non-firm services
- Increased gas use in power sector driving demand for redefined services:
  - No-notice service
  - Intra-day nominations
  - Hourly load swings
  - Minimize reliance on long-haul FT
  - Increase purchases from the nearest liquid market

Transportation Service Agreements (TSAs)

- Legally binding contract between pipeline and customer for services
- Inclusion of force majeure provisions
- Define and maintain the details of service, including the maximum daily quantity (MDQ)
- Types of contracts
  - Transportation (firm, interruptible, no-notice)
  - Storage (firm, interruptible)
  - Other
    - Operational Balancing Agreement (OBA)

Pipeline Transport Risks

- Reliability Risk – Gas will not be delivered in sufficient quantities when needed
  - Pipeline curtailments
  - Pricing point liquidity risk
- Penalty Risk – Financial penalties for the violation of pipeline balancing tolerances and other operational requirements
- Cost Risk – Paying too much for the transportation services needed
  - Best cost strategy that balances costs and risk exposure

Pipeline Transport Risk (cont.)

- Balancing penalties
- Curtailment risk
- On-peak/off-peak generator cycling v. rateable must-take provisions
- Operational flow orders (OFOs)
- Primary/secondary firm v. interruptible

Transportation Options Risk vs. Cost

Option	Risk	Cost
Primary FT back to the supply basin	Lowest	Highest
Primary FT to the nearest liquid pricing point		
Secondary FT (released capacity)		
Seasonal FT		
IT	Highest	Lowest

Transportation – Other Considerations

- Pipeline balancing tolerances and penalties
- LDC balancing tolerances and penalties
- OFOs
- Pipeline and LDC history of curtailments and interruptions

Balancing

- Storage and transportation imbalances/balances based on scheduled gas quantities
- Imbalance:
  - Cumulative difference between inputs and outputs
  - Difference between nomination and scheduled volume
- Balancing:
  - Equalization of gas volumes into the pipeline/LDC system with withdrawals by shipper
  - Balancing tolerance, imbalance allowed before penalties are assessed

Interstate Pipeline OFO Penalties

Pipeline		***OFO Overrun Penalty***
Algonquin		$15 / Dth
Iroquois		$2.50 / Dth, up to 50 Dth $25 / Dth, for additional overruns
Maritimes & Northeast		$50 / Dth
Portland Natural		$2.50 / Dth, up to 50 Dth $25 / Dth, for additional overruns
Tennessee	Action Alert	Twice the otherwise applicable daily charges
	Balancing Alert	$15 + Regional Daily Spot Price / Dth

LDC OFO Penalties

Bay State Gas. Berkshire Gas, KeySpan Energy, NSTAR Gas, New England Gas

Critical Day Condition	*Supplier Action*	*Penalty*
Under-delivery from interstate pipeline (not enough gas)	Overtake from LDC	5 x Daily Index[1] for usage exceeding 102% of Scheduled Daily Allowance
	Undertake from LDC	0.1 x Daily Index for usage less than 80% of Scheduled Daily Allowance
Over-delivery from interstate pipeline (too much gas)	Overtake from LDC	0.1 x Daily Index for usage exceeding 120% of Scheduled Daily Allowance
	Undertake from LDC	5 x Daily Index for usage less than 98% of Scheduled Daily Allowance

Connecticut Natural Gas, Southern Connecticut Gas, Yankee Gas

Season	*Penalty*
Peak	The higher of: 3 x Daily Index or $2.50 / Ccf
Off-Peak	2 x Daily Index

[1] Midpoint of relevant spot price, as reported in *Gas Daily*.

Valuation of Service – Pipeline Transport

- Meeting firm customer demand
- Value = Volume * (Basis Spread – shrink – volumetric rate – other variable costs)
- Pipeline capacity constraints – key driver of market price volatility
- To benefit from basis blowouts, must be able to move gas under capacity restrictions
- Secondary transport markets are priced such that locational arbitrage is difficult
- Informal synergistic relationship w/ pipeline may develop, where pipeline leans on customer's flexibility and vice versa

Transportation Risk Mitigation/Cost Reduction

- Alternate fuel capabilities
- Interruptible operations/fuel use
- Portfolio approach
  - Mix of transportation services and mitigation options to minimize costs with acceptable risk exposure
- Peak sharing w/suppliers, pipelines, LDCs
- Storage

Historical Perspective on Storage

- From 1940's through mid-80's, strictly a utility function
- Open access spawned new value and services
- Levels of service
  - Firm storage service (FSS)
  - Interruptible storage service (ISS)
  - Park and loan service (PAL)
  - Bundling storage w/ transportation services
- Market-based rates
- Proliferation of market hubs and risk management tools

Storage Facilities

- Types: aquifer, depleted reservoir, salt cavern, LNG
- High Deliverability Storage (HDS) allows for greater cycling and extrinsic optionality

Storage Type	Cushion Gas Requirement (% of total gas in storage)	Injection/Withdrawal Period (days)	Cycling Capability (# of turns)
Aquifer	50 – 80	200 – 250 / 100 – 150	2
Depleted Reservoir	50	200 – 250 / 100 – 150	2
Salt Cavern	20 - 30	20 – 40 / 10 - 20	9

Storage Trends

- LDC obligation to serve
- Increased market orientation
- HDS
- Growth of synthetics, *i.e.* financial products emulating physical storage performance
- Global LNG trade / renewed interest in LNG regasification terminals

High-Deliverability Storage (HDS)

- Storage operations dictated by customer needs not seasonality
- Rapid inventory changes
- HDS accounted for 4% of total working gas capacity, but 15% of daily deliverability
- In 2003, 68% of new storage capacity and 83% of new withdrawal capability involved HDS
- HDS provides a physical hedge to mitigate daily as well as seasonal price volatility

New Storage Dynamics

- Variable hourly takes for power generators' load-following requirements
- Avoidance of costly imbalance penalties
- Multiple cycles: summer withdrawal / winter injection
- Price arbitrage
- Merchant storage services
  - Load-following
  - Parking and lending
  - Balancing

Storage Economics

- Pressure v MDQ
- Max injection / withdrawal rates
- Ratchets and/or base gas
- Maximum storage quantity (MSQ)
- Injection cost
- Storage shrink
- Lateral costs

Storage/Transport Customers

- LDCs
  - Obligation to Serve
  - Simple intrinsic transactions
  - Minimize Supply Risk
- Marketers
  - Maximize value
  - Flexibility
  - Complex extrinsic transactions
  - Intra-day trading & arbitrage
- Generators/Large End-users

Storage/Transport Customers (cont.)

- Foster reliable deliveries
- Strengthen the connection between gas requirements and operating regime
- Arbitrage
  - Seasonal gas and transportation costs
  - Gas and electricity prices
- Help weather periodic liquidity squeezes
- Avoid costly imbalance and overrun penalties
- Flexibility

Approach to Managing Storage and Pipeline Capacity

- Value drivers
  - Avoiding physical pipeline constraints
  - Local market volatility
  - Leverage to optimize FT entitlements
  - Seasonal and locational price spreads

Storage Optimization Turns on the Objective Function

- Rival stakeholders have different objective functions
- Optimizing storage operations reflects
  - Risk tolerance
  - Portfolio effect
  - Pipeline constraints
  - Options

Foundation for Storage Valuation

- What is the objective function?
  - Profit Maximization
  - Cost Minimization
  - Other, reliability / security of supply
- What is the decision horizon?
  - Hourly, daily, weekly…
- What is the geographic location?
  - Market v. production area storage
  - Boundary effects across the supply chain
  - Physical links and spatial drivers

Outlook

- Unless transport capacity from production basins to northeast increases and/or new LNG terminals come on-line
  - Characteristics of Winter Season will spread to other seasons
  - Greater reliance on, hence value of storage & needle-peaking facilities
  - Continued degradation of IT
- Pipelines will provide more intra-day services
  - Hourly Load Management
  - PAL
- Customers become more active in seeking customized solutions for storage & transport