Natural Gas Hub Development and the Asian LNG Market

Plenary Session 3, Structure of Asian Markets for Energy Commodities

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Energy Benchmark Characteristics

• Commodity Price Reference
• Regional or National Value Communication
• Strategic Supply/Demand Relevance
• Pricing Derived from Competitive Market Operations
• Transparent Delivery Procedures
• Established Regulatory Structure
• Access to Reliable Physical Delivery
• Delivery Infrastructure Available to New Market Participants
Standard Delivery Function

- Standard Delivery Futures Contract Location
- Operation and Costs Must Be Transparent and Non-discriminatory
- Ensures that Futures and Cash Market Values Converge
- Enables Participants to Close the Futures Contract Obligation with Physical Delivery
- Exchange of Futures for Physicals
- Alternative Delivery Procedure
Henry Hub Background

• In 1988, Sabine Pipe Line initiated Henry Hub service at the Henry Gas Processing Plant near Erath, Louisiana

• Sabine was a wholly owned subsidiary of Texaco. Chevron acquired Texaco and became the next owner/operator of the Henry Hub. Chevron sold Sabine Pipe Line and other midstream assets to Enlink (ENLK) in November 2014.

• In 1990, NYMEX launched its first natural gas futures contract which incorporated the Henry Hub as the standard delivery location.

• The current Henry Hub transportation service provides hub service among 10 inter and intrastate pipeline interconnections. ENLK charges a discounted rate of 4 cents per MMBtu for hub service related to the 10 pipeline interconnections and between these locations and the Sabine Hub Services Intra-Hub Transfers (IHT) agreement.

• IHT is a title transfer service and is provided on a non-jurisdictional basis

• Why was the Henry Hub selected by NYMEX?
U.S. Natural Gas Flows

Source: Energy Information Administration, Office of Oil and Gas, Natural Gas Division, GasTran Gas Transportation Information System.

The EIA has determined that the informational map displays here do not raise security concerns, based on the application of the Federal Geographic Data Committee’s Guidelines for Providing Appropriate Access to Geospatial Data in Response to Security Concerns.
Percent of Louisiana OCS of Total U.S. Annual Natural Gas Consumption

Source: EIA and LA Department of Natural Resources
Platts Henry Hub Monthly Volumes From 2004-2015
000's MMBtu/Day
Henry Hub Delivery Operating Capacity and Scheduled Quantity (MMBtu)

<table>
<thead>
<tr>
<th>Date</th>
<th>Op Cap</th>
<th>TSQ</th>
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<tbody>
<tr>
<td>3/1/2015</td>
<td>148,686</td>
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<td>4/1/2015</td>
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<tr>
<td>1/1/2016</td>
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<td>-</td>
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U.S. Shale Production Areas

- Bakken
- Niobrara
- Permian
- Eagle Ford
- Utica
- Haynesville
- Marcelius
Annual Increase in Shale Production Compared to Conventional Production
Physical Hub Characteristics

- Strategic Hub Location
- Trusted Physical Operator
- Transparent Facility Fees
- Non-Discriminatory Third Party Facility Access
- Sufficient Facility Transfer Capacity
- Access to Storage at or Close to the Facility
- Facility Operator Interest in Business Development
- Delivery/Storage Expansion Capability
Financial Hub Characteristics

• Services that Complement Physical Facility Operations
• Title Transfer/Book Transfer
• Henry Hub Intra-hub Transfers (IHT)
• Facilitates Title Transfers at Low and Known Cost
• Anonymous Sourcing through IHT
• Can Be Offered by Operator or Third Party
The Asian Natural Gas Market

• Asia is the Fastest Growing Natural Gas Consumption Market
• LNG Is the Primary Natural Gas Supply
• Regional Natural Gas Markets Are Not Uniformly Connected By Pipelines
• Increasing Focus on Pipeline Delivery
• Historical Natural Gas Pricing is Based on Oil-Based Indexation
• Increasing Interest in Gas-to-Gas Competitive Pricing
• Development of LNG Price Indices
• Asia Lacks a Natural Gas/LNG Physically Delivered Trading Hub
Monthly Brent Spot in MMBtu

$21.63

$8.23

$6.55
Brent Spot MMBtu and the Henry Hub Spot Price

Henry Hub
Brent MMBtu
Difference
Source: EIA
Cheniere Energy LNG Pricing

• *Henry Hub* means the final settlement price (in USD per MMBtu) for the New York Mercantile Exchange’s Henry Hub natural gas futures contract for the month in which a relevant cargo’s delivery window is scheduled to begin;

• Under the SPAs, the customers

• will purchase LNG from Sabine Pass Liquefaction for a price consisting of a fixed fee plus 115% of Henry Hub per MMBtu of LNG.

Source: Cheniere SEC Filings
# Cheniere Energy Long-Term LNG Pricing Example

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>Henry Hub Final Settlement for February 2016:</td>
<td>$2.19</td>
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<tr>
<td>115% of Final Settlement:</td>
<td>$2.52</td>
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<tr>
<td>Liquefaction Fee:</td>
<td>$3.50</td>
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<tr>
<td>Total Price Without Shipping Cost:</td>
<td>$6.02</td>
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ICE Brent on 1/27/16: $33.10  
MMBtu Conversion: $5.71
Asian LNG Market Pricing Developments

• Platts Japan Korea Marker (JKM) Launched in February 2009
  • Daily Market on Close Price Assessment of Bids, Offers, and Trades
• Increasing Interest in Spot and Short-Term Deals
• Exchange Cleared JKM Futures
  • Intercontinental Exchange Launched JKM Cleared Swap in 2012 (Converted to Futures)
    • 24 Consecutive Trading Months Listed
    • 3/16-12/16 Open Interest of 750 Contracts as of 2/11/16
  • CME Group Launched JKM Cleared Swap Futures in 2012
    • 12 Consecutive Trading Months listed
    • No Open Interest or Recent Trades
Asian LNG Market Pricing Developments

- 9/14: FOB Singapore SGX LNG Index Launched by SGX and EMC
- 9/12/14: Japan OTC Exchange (JOE) Lists LNG Non-Deliverable Forward Contract
- 1/25/16: SGX FOB Singapore SLInG LNG Futures and Swaps Launched
- 2/22/16: CME Group to List LNG DES Japan RIM Futures to Clear JOE trades
Singapore Developments

• Government/Energy Market Authority Support Energy Hub Development
• Development and Operation of the Singapore LNG Corporation
• SGX Launch of FOB Singapore SGX LNG Index, Swaps, and Futures
• Increased Competition in the Commodity Exchange Sector
  • 2014: ICE Acquires Singapore Mercantile Exchange renamed ICE Futures Singapore
Summary

• Henry Hub selected due to its location which was relevant to the developing interstate spot market and the related access to Gulf production

• Physical deals and volumes have steadily declined along with OCS and Gulf regional onshore production

• Henry Hub continues to be relevant as a benchmark for U.S. Gulf pricing. The start of LNG Gulf exports is a supporting factor through conditioned on world LNG pricing

• Asian natural gas market interest in alternatives to oil indexation

• Multiple LNG price indices have developed since 2009: JKM, SGX LNG Index, and RIM. JKM is the most visible to date. The ICE JKM futures contract is the most active as to volume, open interest, and forward pricing.

• A physically delivered hub location has not yet developed. Such a location could form the foundation for a physical and financial benchmark for Asian natural gas.
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