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Global Natural Gas Markets: Recent Trends & Emerging Fundamentals

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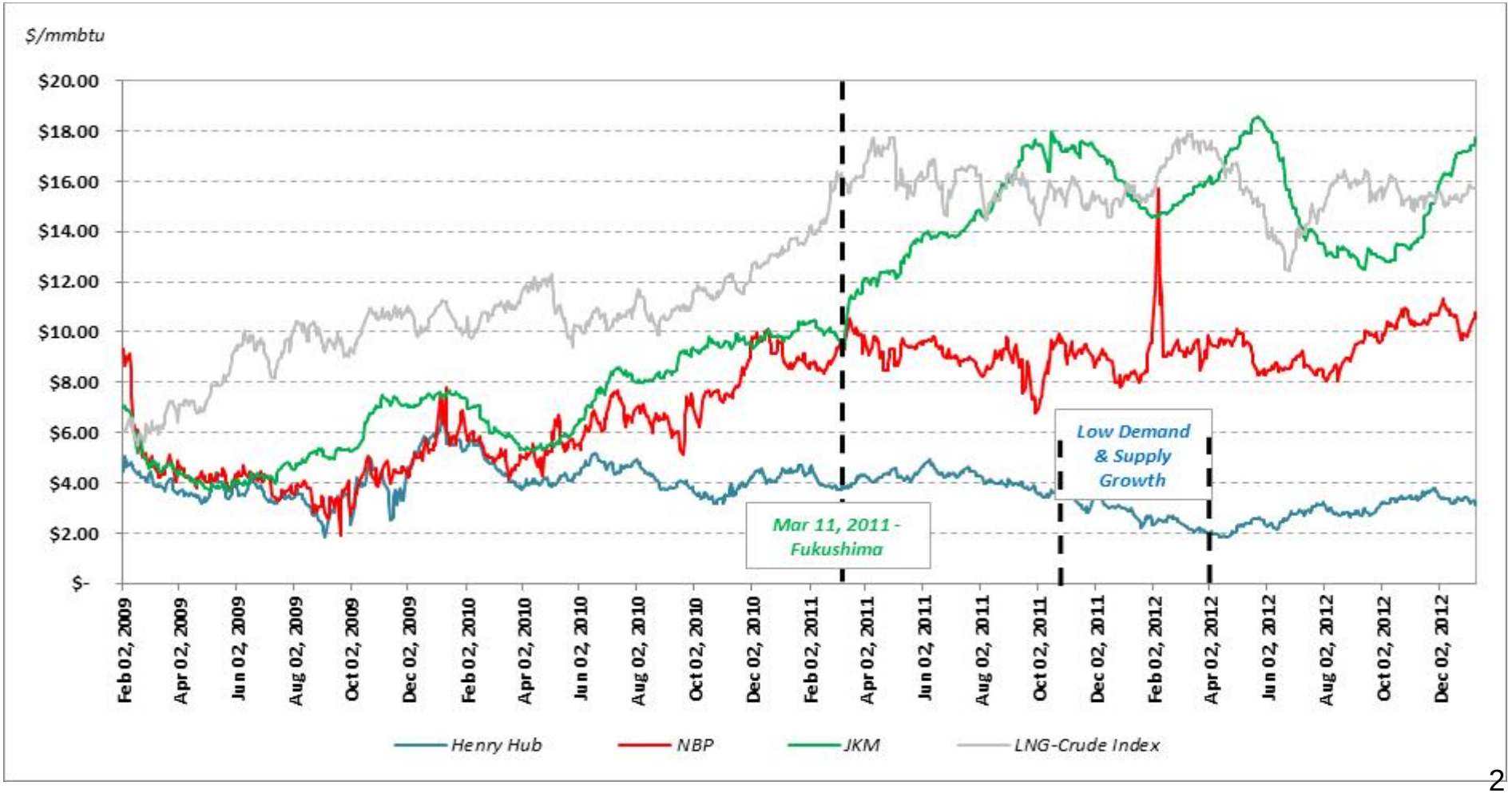
International Prices

- Note change in regional price relationships post-March 2011?



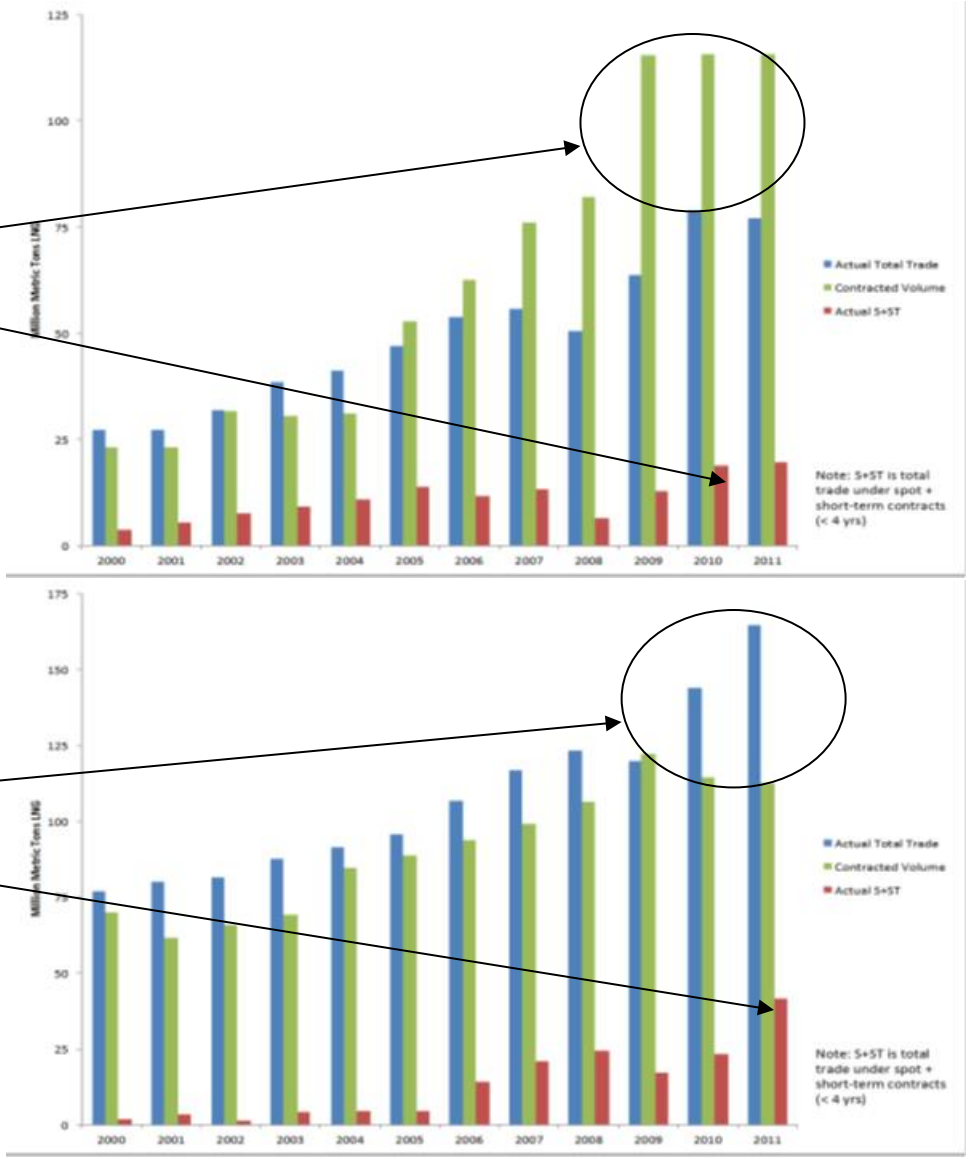
Price data from Platts; LNG Oil-Index author's calculation

International prices: A wild ride…

- International spot prices diverged dramatically in 2011 in the wake of an unexpected demand shock triggered by the disaster at Fukushima
  - It only took 8 months for JKM to significantly depart from its previous equilibrium with world prices.
- US prices began to diverge earlier due to dramatic growth in shale gas production.
  - An inability to export gas from the US to Asia effectively locks in a large spread.
- Prices will adjust in all markets once trade begins, but the degree depends on the relative elasticities of demand and supply in each market.
  - Our research indicates the biggest response will be in Asia.
  - When it happens, it will happen fast!

Contracts and Flows

- Atlantic Basin LNG diverted…
  - short term volumes expand
- … Pacific Basin LNG expands.
  - short term volumes expand



Data Sourced from the International Group of Liquefied Natural Gas Importers (GIIGNL)

Shale, shale everywhere? Maybe, but the US is unique.

- Stable and conducive regulatory and institutional frameworks.
  - **Resource Access** – mineral rights ownership; acreage acquisition; resource assessments; environmental opposition; etc.
  - **Market Structure** – transportation regulation (unbundled access vs. incumbent monopolies) and bilateral take-or-pay obligations vs. marketable rights; existence of infrastructure; pricing paradigms; etc.
  - **Market Maturity** – service sector scale and performance capability; developed infrastructure; hub pricing; storage capabilities; etc.
- Many other issues face shale development.
  - Water use in production; water rights and management; flow back options (recycle and/or treatment and disposal); concerns about watershed protection (casing failures and fracture migration); earthquakes related to injection of produced water; long term effects of methane escape; concerns about contamination from produced water; ecological concerns over land use and reclamation; etc.

A Comment on US LNG Exports

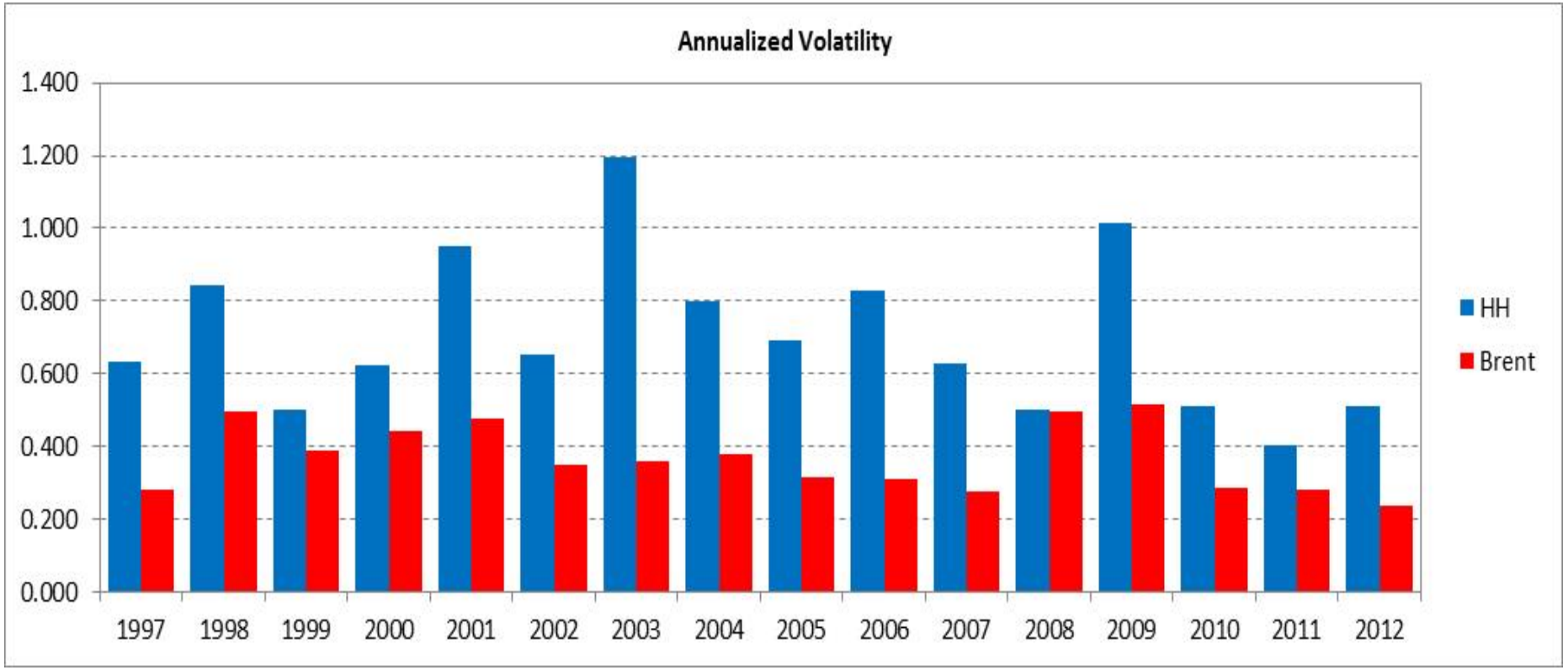
The Potential Impact of US LNG Exports

- Lots of attention given to current international spot price, but several factors are often ignored, such as
  - short term capacity constraints,
  - the effect of exports on markets abroad, and
  - a weak US dollar.
- US LNG exports will put significant pressure on international pricing paradigms.
  - In 2012, LNG trade was just over 30 bcfd. Current filings exceed 30 bcfd, and, as of the time of preparation, current approvals to non-FTA countries is just over 6 bcfd.
  - Prices will adjust, and greater liquidity will alter the market paradigm in a substantial way.

More on US LNG Exports

- Export capacity will be built on the expectation that rents from arbitrage will "pay" for the fixed cost.
  - But, it is possible that some terminals will not earn the *ex-ante* required rate of return, contingent on the off-take agreement and who bears risk.
- US LNG export capacity could be used for seasonal arbitrage. If *seasonal* price differences among the regional markets are sufficient, US exports will be profitable during those periods.
- LNG exports from the US will link global markets to storage in the US. Thus, liquidity will spill over and contribute to very different market paradigm.

One impact: changes in price volatility



- Economic theory predicts the more fungible (or tradable) a commodity is, the lower its price volatility, all else equal.
- Thus, LNG exports from the US could result in lower price volatility, both domestically and abroad.

Broader insights gleaned from modeling global gas markets

Key Market Insights

- Effect of North American shale
  - North America is a potential supply source – a dramatic shift from being an expected demand sink just ten years ago.
  - Reliance on supplies from Middle East, North and West Africa is eliminated, which reshuffles international gas trade relationships globally.
- Effect of international shale, if it happens…
  - Shale gas, if developed everywhere, reduces price and lowers the need for LNG supply to both the Atlantic and Pacific basins and pipeline supply to Europe and Asia.
  - This outcome weakens gas rich countries such as Russia, Iran and Venezuela in the longer term, all of which benefit the most if shale development does not occur.

Key Market Insights (cont.)

- Importance of China
  - Chinese demand and supply are both critical drivers of the global gas market over the next couple of decades.
  - Australia and China are intimately linked.
- Effect of environmental policy
  - Environmental policies – such as efforts to reduce CO_2, particulates, mercury, SO_x and NO_x – promote gas demand.
  - Such policies also provide long term price support and facilitate LNG market growth.
- Effect of a stable investment climate in the Middle East
  - Higher global dependence on the region.
  - Iran emerges as a large exporter via pipeline and LNG.

Key Market Insights (cont.)

- Importance of the cost environment
  - If costs remain at their current levels, there is benefit legacy capacity holders. New entry requires high price.
- What about Russia?
  - Gazprom must become more competitive. (i) Shale opponent, (ii) support climate initiatives, (iii) internal market changes, (iv) export monopoly status to be challenged, (v) need to attract capital, etc.
- The value of long-term contracts?
  - Flexibility provides real option value. If suppliers have flexible destination capability, they benefit.
  - Rigid contract structures can limit capability to capture market share in emerging growth markets.

Questions/Comments