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WHITE PAPER

Uncharted Waters Ahead: Volatile Unknowns in the Liquefied Natural Gas Market

A whitepaper prepared by

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October 2008



INTRODUCTION

Sparked by energy shortage concerns and new cost-effective technologies, the popularity of liquefied natural gas (LNG) has exploded over the past few years.

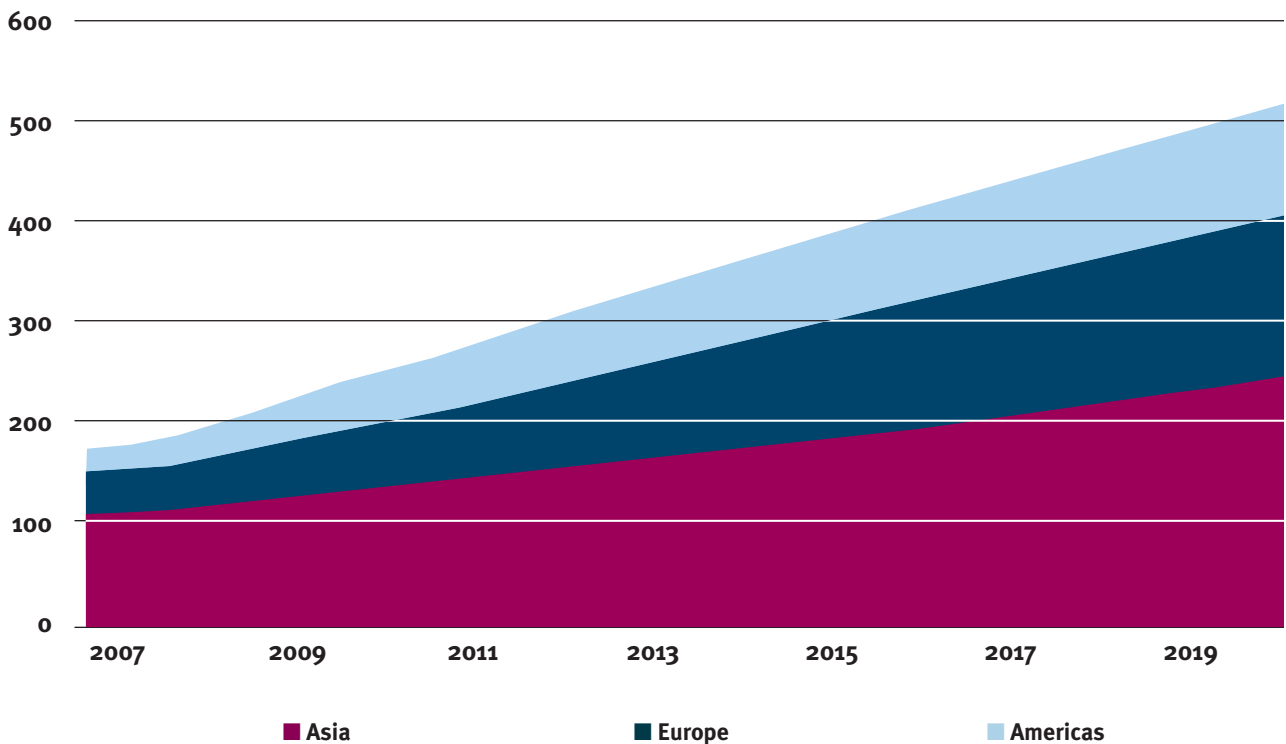
The LNG industry is responding by adding new liquefaction capacity that market participants hope will serve this increasing demand. Worldwide, current LNG capacity stands at 175 million metric tons a year (mt/year). But according to Andy Flower, a London-based industry consultant and former BP executive, an additional 52 million mt/year of global LNG capacity will come online by the end of 2009. Other estimates place the new capacity as high as 58 million mt/year. That would be a 30 percent to 33 percent boost in just 15 months. The additional volume to be produced in 2009 would be around 25 million mt, only about half the new capacity, due to the time needed for new plants to ramp up operations to full capacities, Flower estimates.

Despite the new capacity, the LNG market still faces serious uncertainties. Among the top five concerns of producers, consumers, traders and analysts are:

1. Delayed LNG projects
2. Engineering unknowns
3. Labor shortages / rising material costs
4. Increasing U.S. natural gas supply
5. A volatile trading market

From technical problems at new plants to new shale gas finds, there are many factors making the LNG waters choppy now than they were just a year ago. And with the global energy market apt to shift course on a moment's notice, LNG players would be wise to constantly track these dynamics. Here's a look at what's driving so much ambiguity.

POTENTIAL GLOBAL LNG DEMAND 2007 TO 2020
(Millions of tons per year)



Source: FlowerLNG

1. MANY LNG PROJECTS ARE EXPERIENCING DELAYS

Because of increased demand for new energy, especially from developing economies, countries have stepped up construction of liquefaction plants and consumer countries have ramped up efforts to build receiving terminals. However, several major projects have been hit with delays, cost overruns and other problems, making it difficult to accurately predict when these new plants will reach maximum capacity.

Norway's **Snohvit** project, for instance—the first liquefaction plant north of the Arctic Circle—has suffered extended problems since being commissioned in 2007. In January, operator StatoilHydro said the project would not reach 100 percent capacity until 2009 because parts of the onshore plant needed to be modified. In October, the plant shut down for four more weeks of maintenance.

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The plant, which is expected to produce 4.2 million mt/year, has faced skepticism about being at full capacity by 2009. Snohvit's train was late coming online in 2007. Then it never exceeded 60 percent production capacity before being shut down for two months in May 2008 for maintenance. The train is now back online but is still producing at only 60 percent. Officials plan to shut the train down again in 2009 for maintenance hoping that it will run at 100 percent capacity later in the year.

In addition, the **Sakhalin 2** project has faced several delays resulting from changes in equity stakes to charges of environmental violations. At one point, officials said the first train would be completed in mid-2007 and the project was supposed to begin supplying Korea Gas in January 2008. That deadline was missed and the project is now expected to be online in spring 2009.

Plus, just about every new liquefaction train project has faced labor shortages and rising materials costs—causing many operators to slow down construction. The bottom line: Too many variables exist to predict when each new train will come online.

2. ENGINEERING QUESTIONS CLOUD OUTLOOK

A series of mega projects are well under way in Qatar. The project, spearheaded by **Qatar Petroleum**, should soon unveil the first of the world's largest trains. Each of Qatar's new mega trains will have a capacity of 7.8 million mt/year for a total capacity of 46.8 million mt/year between late 2008 and 2011.

Some insiders expect one train to be online soon, as early as late 2008. "I'll be surprised if early next year it is not producing cargoes," says Morton Frisch, senior partner at Morton Frisch Consulting. "It's a very prestigious project for the Qataris. Heads would roll if it isn't producing by then."

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However, mega trains are still unproven. And there are some concerns about how efficiently they will run on startup. If there are no hitches, the LNG produced in Qatar would add substantial amounts to the global supply.

Another project on the watch list is the **Tangguh** plant in Indonesia, expected to eventually produce 7.6 million mt/year from two trains. The plant is being built by BP, which hasn't commissioned a plant recently. In addition, Tangguh has faced similar shortages in supply and labor that other projects face.

ADDITIONAL LIQUEFACTION CAPACITY THROUGH 2010



Project	Location	Capacity (mil mt/yr)	Expected Start	Destination
1 Qatargas 2 – Trains 4/5	Qatar	7.8 each	Q4 2008/Q4 2009	UK: 12.2 mil mt/yr, but diversion likely France: 1.85 mil mt/yr Mexico: 700,000 mil mt/yr U.S. / Asia: unknown
2 Tangguh – Trains 1/2	Indonesia	3.8 each	Q4 2008 to Q1 2009/Mid 2009	China: 2.6 mil mt/yr South Korea: 1.15 mil mt/yr Japan: 120,000 mil mt/yr U.S./Mexico: 3.7 mil mt/yr (nearly half could be diverted to Asia)
3 RasGas 2 – Trains 6/7	Qatar	7.8 each	Q1 2009/Q4 2009 to Q1 2010	U.S. but diversion likely.
4 Yemen – Trains 1/2	Yemen	3.35 each	Maybe Mid 2009/ Maybe Late 2009	U.S.: 4.5 mil mt/yr (possible diversions) Korea: 2 mil mt/yr
5 Sakhalin – Trains 1/2	Russia	4.8 each	Q2 2009/Q4 2009	Japan: 6.5 mil mt/yr U.S./Mexico: 1.6 mil mt/yr (with possible diversions) South Korea: 1.5 mil mt/yr
6 Northwest Shelf – Train 5	Australia	4.4	Q4 2008	Probably all to Asian buyers
7 Dua	Malaysia	1.5	Possibly 2009	Possibly existing customers in Japan and South Korea

Source: Platts

3. LABOR SHORTAGES AND RISING MATERIAL COSTS PUT PRESSURE ON PROJECTS

Liquefaction projects have suffered with across-the-board labor shortages over the past few years. LNG operators are finding it difficult to find enough qualified engineers, plumbers, welders and even manual workers.

BP is not exempt. The company's Tangguh project faces a generation gap with personnel. Most older, experienced personnel have retired. And younger people don't have any experience commissioning LNG trains. In an effort to get more experience on the project, Frisch says, BP recently offered one 72-year-old enough money to come out of retirement to help with commissioning.

Planned projects in Australia and Papua New Guinea will likely face similar labor shortages. There are plans for 19 new projects in that region that would increase LNG production sevenfold. But BHP Billiton Petroleum CEO Michael Yeager has said that Western Australia was facing one of the worst deficiencies of labor and materials in the world.

Making matters worse for plant builders, the cost of materials such as steel and cement continues to climb. According to Bali Steel, the price of the alloy has increased 100 percent from September 2007 to the same month this year. Some experts believe the world is facing a steel shortage. Lakshmi Mittal, CEO of metal company ArcelorMittal, recently quoted in Abu Dhabi publication *The National*, expressed serious concern over this potential dearth.

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Combine labor and material shortages with rising wages and prices and there is substantial reason to be cautious going forward.

4. MORE U.S. NATURAL GAS IS BEING PRODUCED

Just a few months ago, the U.S. Department of Energy was predicting that the United States would import record amounts of LNG in 2009 as a result of increasing global liquefaction capacity and high domestic gas prices. In July, the benchmark Henry Hub gas price was \$13/MMBtu. Since then, however, U.S. gas prices at the Henry Hub have *dropped* to less than \$8/MMBtu.

This is due in part to rising domestic natural gas production. And that is due in part to new natural gas production from shale gas plays such as the Barnett Shale in Texas. More U.S. producers are ramping up production from these shale gas fields, resulting in predictions of sizeable production increases over the next few years.

...the Department of Energy recently slashed its Henry Hub gas price estimate for 2009 to \$9.01 per thousand cubic feet. The department also said that U.S. LNG imports were expected to "remain low" compared with Europe and Asia and that LNG imports would be lower than previously expected.

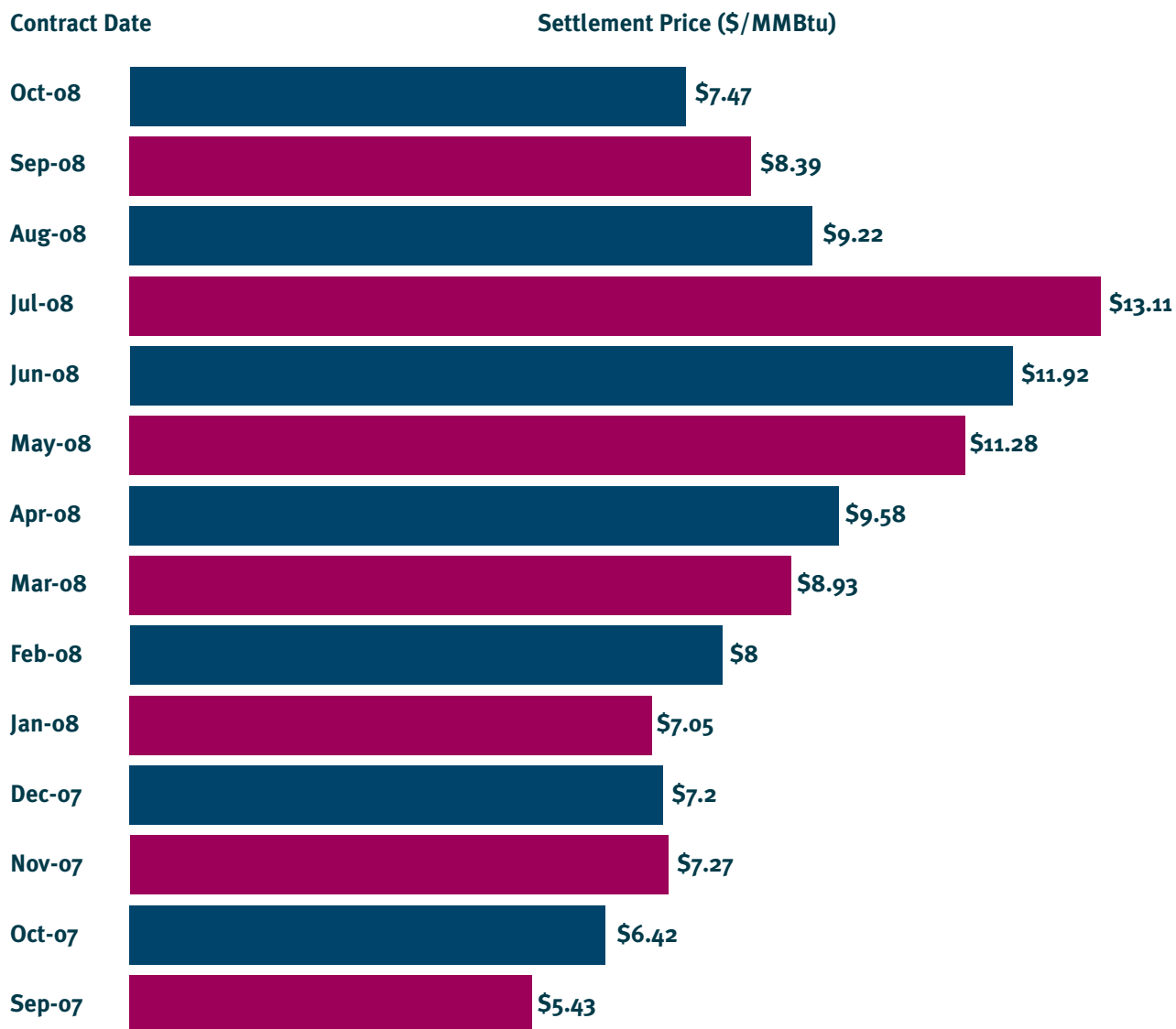
In August, investment bank Barclays Capital issued a report forecasting U.S. domestic gas production would increase as much as 3.8 billion cubic feet a day (Bcf/d) this year and as much as 3 Bcf/d in 2009. That followed a report in July by Navigant Consulting that predicted the nation's recoverable gas reserves were 2,247 trillion cubic feet.

As a result of increased production, the Department of Energy recently slashed its Henry Hub gas price estimate for 2009 to \$9.01 per thousand cubic feet. The department also said that U.S. LNG imports were expected to "remain low" compared with Europe and Asia and that LNG imports would be *lower* than previously expected.

Despite the United States' boosted natural gas production, the country could still get flooded with LNG surplus. That's because there are times in the spring and fall when Japan and Korea can't absorb all the spare LNG. In addition, there are times when only so much supply can go to Europe and South America, while the United States has a huge storage capacity. "The U.S. could become a 'sink' for surplus LNG," says Wayne Perry, managing director of the Galway Group, an investment bank and consulting group.

Further, if domestic natural gas supply continues to increase and the United States is the only place that can take surplus LNG, incoming cargoes could depress natural gas prices even further, Perry adds. "You might see a freefall in gas prices."

NATURAL GAS PRICES



Source: New York Mercantile Exchange

5. THE LNG TRADING MARKET IS VOLATILE

The actions of other countries have a major effect on the LNG market. Factors such as pollution, geography and even seasonality affect buying and producing trends. Three areas to watch include Asia, Qatar and South America.

Asia

The amount of Atlantic Basin LNG production sent to Asia has been growing rapidly over the past few years. For the first quarter, 4.12 million mt of LNG was sent to Asia from the Atlantic—a 265 percent increase from the same quarter in 2007, according to data provided by Flower.

With the new capacity that's expected by late 2009, Asian buyers could soon look forward to nearly 14 million mt/year more from producers closer to the region—such as Indonesia. The country's Tangguh plant, for example, would likely send 49 percent of its capacity to long-term customers in China, South Korea and Japan. Those shipments could actually increase because other Asian buyers such as Korea Gas have expressed interest to buy portions of the remaining Tangguh production originally slated for U.S.-based Sempra Energy.

But the cost of LNG is increasingly becoming a problem for importers such as China. The country's Guangdong-Dapeng LNG receiving terminal in early September decided to suspend importing the fuel until prices come down substantially. The terminal, which can import 3.7 million mt/year, has paid as much as \$20/MMBtu. It had paid \$14/MMBtu in spring.

At the same time, China continues to face pollution problems caused by coal-fired power plants and could increase its demand for spot LNG if prices fall next year. India might also step up to buy surplus LNG as more liquefaction capacity comes online. LNG buyers and sellers will be watching the status of Tokyo Electric Power's 8.2-gigawatt Kashiwazaki-Kariwa nuclear plant in 2009. TEPCO has said it will bring two units of that plant back online early next year, although there continues to be local opposition to restarting the plant. If units are restarted, it would reduce LNG demand in Japan, freeing up supplies for other markets.

Qatar

On the supply end of the LNG market, the new production capacity in Qatar is a wildcard. The country will account for more than half of the world's new supply through 2010 once Qatar's new trains are at full capacity.

Much of Qatar's new capacity was originally slated to target UK and U.S. markets under long-term deals signed by buyers such as ExxonMobil, ConocoPhillips, Royal Dutch Shell and Total. However, most of these supplies will likely go to the highest bidder, regardless of geography. Further, Qatargas has increased its import capacity in US and UK-based regasification terminals and will play a major part in determining the LNG destination, too.

South America

South America is another variable in the global LNG market. That's because the region is emerging as another LNG destination market. Brazil and Argentina earlier this year started to import LNG. In 2009, Chile will likely enter the game. That country could potentially siphon off LNG that was coming to the United States because Chile would pay higher prices. And now Uruguay is considering a floating import terminal for the short term and possibly a permanent onshore terminal for the long term, adding another importing country to the global LNG market.

However, Brazil's demand is seasonal due to wet and dry seasons, the wet season equating to more domestic hydropower and the dry season equating to more LNG imports.

Winter and summer demand also will have an effect. When it's summer (low demand) in North America, it's winter (high demand) in South America. Now that South America is in the market, those countries will be buying cargoes during what's typically a low-demand season in the Northern Hemisphere's summer.

CONCLUSION

The world is waiting for an escalation in liquefaction capacity. With new liquefaction from Qatar to Australia planned to go online at full capacity, the market will see a new supply of LNG never before seen. However, many dynamics exist from lower U.S. natural gas prices to fluid global buying trends that make

the LNG waters more difficult for traders, investors and others in the energy industry to navigate. That is why they should be armed with as much real-time decision-making information as possible.



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