Global Equity Research

Industry Focus

North America US
Energy Integrated Oil

22 July 2004

Global LNG

Exploding the Myths

Deutsche Bank

F.I.T.T. Research

Fundamental, Industry, Thematic, Thought Leading
Deutsche Bank Equity Research's Research Product Committee has deemed this work F.I.T.T. for our clients seeking differentiated ideas. Here our global oils team issues the latest in its series of annual probes into the liquefied natural gas (LNG) market. This year's focus is on clearing up widely held misconceptions.

Fundamental: a global LNG market model is our foundation

Industry: LNG boom? What LNG boom?

Thematic: no problems with US regasification or market access

Thought Leading: lifting the veil of assorted other illusions

In terms of LNG, we favour the first movers

"Not in my backyard" – more shocks over US gas safety

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DISCLOSURES AND ANALYST CERTIFICATIONS ARE LOCATED IN APPENDIX 1

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Fundamental: a global LNG market model is our foundation

Last year we identified a long-term secular trend: LNG will be the oil of the 21st Century. This year, we once again delve into global LNG supply/demand trends to form our updated near-term and long-term outlook. Growth has generated interest; interest has generated myths.

Industry: LNG boom? What LNG boom?

Despite huge global gas prices, no major new "greenfield" LNG project is starting up this year. Gas reserves are abundant and there is considerable spare LNG shipping capacity, yet few new developments. Growth in LNG is strong, but hardly impressive from a low base (oil demand growth is greater than gas demand growth this year). This report looks at why there is not more development. The answer lies in the scale of the challenge.

Thematic: no problems with US regasification or market access

The economic opportunity of $6 US gas is overwhelming. Our analysis focuses on the winners of the clear themes: a higher sustained US gas price, a massive need for development expenditure, and a lack of action that will reward the first movers of the past five years.

Thought Leading: lifting the veil of assorted other illusions

As a "hot topic" LNG has quickly developed its own set of myths. Our LNG theme this year is to explode these myths, the biggest of which is a perceived problem with US regasification capacity – which there is not. The four existing terminals have yet to sell out. LNG is safe, and the public in the US Gulf Coast supports its development. We do not see a significant issue with access to the US gas market.

In terms of LNG, we favour the first movers

Until sufficient LNG supply is developed to meet the need for gas in the US – at least five years – natural gas prices will be high. Companies that can begin to meet the market's needs are the winners – select US E&Ps, early-moving LNG suppliers that are now successfully supplying gas (Shell, BP, BG, TOTAL and Repsol) and companies moving now to develop nearer-term supply (Marathon, ExxonMobil, ConocoPhillips). The theme of major LNG project investment is a good one for developers such as Halliburton and Technip, and the chemical company, Air Products.

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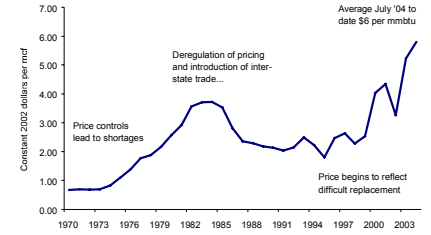
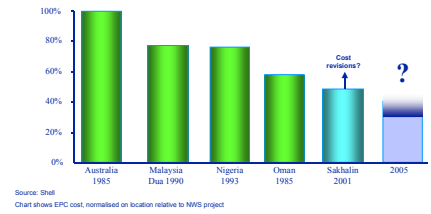
US Gas Prices Rising



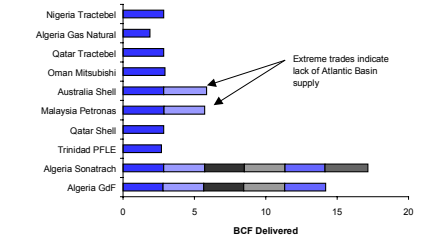
Source: DOE, World Bank]

The industry now wastes less money



Source: Shell., Wood Mackenzie

January to June 2004 LNG deliveries to Lake Charles



Source: Waterbourne LNG report

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Figure 1: World LNG supply and demand balance – projects and players

Demand (Mt)		1990	1995	2000	2004E	2005E	2006E	2007E	2010E	2015E	2004-2007 CAGR
Japan	Japan Inc. utilities esp. Tokyo Electric	32.4	43.6	53.4	57.7	58.3	60.2	62.1	67.8	75.6	2%
South Korea	Kogas	2.1	7.1	15.0	20.2	25.2	27.8	30.4	38.1	48.4	15%
Taiwan	CPC	0.7	2.5	4.3	5.9	6.4	6.9	7.4	9.0	13.5	8%
India	Petronet				2.0	5.7	6.6	7.6	10.5	16.0	56%
China	CNOOC						2.0	2.5	7.1	13.0	
Asia		**35.2**	**53.2**	**72.7**	**85.9**	**95.6**	**103.5**	**110.0**	**132.5**	**166.5**	**9%**
Belgium	Tractebel, Shell	3.2	3.6	2.5	3.0	3.1	3.3	3.5	4.2	5.0	5%
France	GdF	6.1	7.0	9.0	9.2	8.8	9.4	10.0	11.8	14.0	3%
Greece	DEPA			0.4	0.5	0.5	0.6	0.6	0.8	1.2	11%
Italy	ENI, BG	0.2	1.0	1.6	3.6	3.7	5.0	6.4	10.4	10.8	21%
Portugal	Galp		0.0	0.2	1.3	1.6	1.9	2.1	2.8	3.7	17%
Spain	Gas Natural, BP, Cepsa	3.9	3.4	6.9	13.9	15.5	16.2	16.8	18.8	35.2	7%
Turkey	Botas			3.3	2.9	2.1	2.5	2.9	4.0	6.0	-1%
UK	ExxonMobil, Lattice, BG					2.6	6.1	9.5	19.9	27.2	
Europe		**13.4**	**15.0**	**23.9**	**34.3**	**37.9**	**44.9**	**51.8**	**72.7**	**103.0**	**15%**
US East Coast	BG, Trac'bel, Shell, BP, Chevron, AES	1.7	0.4	4.9	12.7	15.0	18.7	27.7	45.0	70.0	30%
US West Coast	El Paso, Shell, Bolivia LNG								5.0	10.0	
USA		**1.7**	**0.4**	**4.9**	**12.7**	**15.0**	**18.7**	**27.7**	**50.0**	**80.0**	**30%**
Puerto Rico	Repsol			0.3	0.7	0.9	1.0	1.2	1.6	2.5	20%
Dominican Republic	AES				0.7	0.7	0.7	0.7	0.7	0.7	0%
Mexico	Shell, Marathon, ConocoPhillips						0.9	3.6	11.3	15.8	
Brazil	Petrobras, Shell								1.9	4.0	
Americas		**1.7**	**0.4**	**5.1**	**14.1**	**16.5**	**21.3**	**33.2**	**65.5**	**103.0**	**33%**
Total demand		**50.2**	**68.6**	**101.8**	**134.3**	**150.0**	**169.7**	**195.0**	**270.6**	**372.5**	**13%**
% Annual Growth			6.4%	8.2%	7.3%	11.7%	13.1%	14.9%	12.5%	6.6%	
Asian Market Share		70.0%	77.6%	71.4%	63.9%	63.7%	61.0%	56.4%	49.0%	44.7%	-4%

Supply Brownfield (Mt)		1990	1995	2000	2004E	2005E	2006E	2007E	2010E	2015E	2003-2007 CAGR
Abu Dhabi	Adnoc, BP, Mitsui, TOTAL	4.5	4.5	5.1	5.4	5.5	5.5	5.5	5.5	5.5	1%
Algeria	Sonatrach	24.5	24.5	23.6	19.5	20.0	20.0	21.0	24.4	28.4	3%
Australia NWS	Woodside, BP, Chevron, BHP, Shell, MIMI	3.0	7.2	7.3	7.6	7.6	7.6	7.6	7.6	7.6	0%
Australia NWS IV	Woodside, BP, Chevron, BHP, Shell, MIMI				1.5	3.5	3.5	3.5	3.5	3.5	33%
Australia NWS V	Woodside, BP, Chevron, BHP, Shell, MIMI								4.2	4.2	
Brunei	Brunei Coldgas, Shell, Mitsubishi	5.1	5.5	6.7	7.0	6.6	6.6	6.6	6.6	6.6	-2%
Indonesia Arun	ExxonMobil, Pertamina	11.9	11.5	6.0	5.8	5.6	5.1	4.6	3.0	1.1	-8%
Indonesia Bontang	TOTAL, Unocal, BP, Pertamina	11.1	13.8	21.2	19.1	22.5	22.5	22.5	22.5	22.5	6%
Indonesia Bontang I	TOTAL, Unocal, BP, Pertamina								3.5	3.5	
Libya	Sirte	1.2	0.8	0.6	0.6	0.5	0.5	0.5	0.5	0.5	-4%
Malaysia	Petronas, Shell, Mitsubishi, Sarawak Govt.	6.6	9.5	15.3	15.0	15.0	15.0	15.0	15.0	15.0	0%
MLNG Tiga	Petronas, Shell, Mitsubishi, Sarawak Govt.				4.0	6.8	6.8	6.8	6.8	6.8	19%
Nigeria LNG I-III	NNPC, Shell, TOTAL, ENI			4.5	8.7	8.7	8.7	8.7	8.7	8.7	0%
NLNG Plus	NNPC, Shell, TOTAL, ENI				5.1	8.1	8.1	8.1	8.1	8.1	17%
NLNG Plus Plus	NNPC, Shell, TOTAL, ENI						4.1	4.1	4.1	4.1	
Oman	Shell, TOTAL, MIMI, Numerous Korean			2.1	6.7	6.7	6.7	6.7	6.7	6.7	0%
Oman II Qalhat	Oman Govt, Oman LNG, Union Fenosa						1.5	3.3	3.3	3.3	
QatarGas	QGPC, ExxonMobil, TOTAL, Marubeni, Mitsui			6.6	8.7	9.2	9.2	9.2	9.2	9.2	2%
QatarGas II	QGPC, ExxonMobil, TOTAL							3.5	15.0	15.0	
QatarGas III	QGPC, ConocoPhillips								7.5	15.0	
Rasgas	QGPC, ExxonMobil, Kogas, Itochu, Nissho Iwai			3.8	6.7	6.7	6.7	6.7	6.7	6.7	0%
Rasgas T3 & 4	QGPC, ExxonMobil, Petronet, UK				3.5	6.3	9.4	14.1	14.1	14.1	59%
Trinidad I	BP, Repsol, BG,Tractebel, Govt. of T&T			3.0	3.3	3.3	3.3	3.3	3.3	3.3	0%
Trinidad II, III & IV	BP, Repsol, BG,Tractebel, Govt. of T&T				6.7	6.7	11.9	11.9	11.9	11.9	21%
Trinidad V	BP, Repsol, BG,Tractebel, Govt. of T&T								4.0	4.0	
Kenai USA	Phillips, Marathon	1.2	1.2	1.4	1.3	1.3	1.3	1.3	0.8	0.4	1%
Brownfield Supply		**69.1**	**78.5**	**107.1**	**136.2**	**150.7**	**164.0**	**174.5**	**206.5**	**215.7**	**9%**
% 5 year Annual Growth			2.6%	6.4%	7.4%	7.1%	8.1%	8.2%	6.5%	5.6%	3%
Supply Greenfield					**9.9%**						
Angola	ChevronTexaco, Sonangol, TOTAL, BP, ExxonMobil								2.0	8.0	
Bayu Undan	Phillips, Shell, Woodside					1.5	3.0	3.0	3.0	3.0	
Egypt LNG I	BG, Petronas, EGPC					0.7	3.5	3.5	3.5	3.5	
Egypt LNG II	BG, Petronas, EGPC						1.8	3.5	3.5	3.5	
Egypt LNG III+	BG, Petronas, EGPC, Apache								4.0	4.0	
Egypt SEGAS LNG	EGPC, Union Fenosa, Eni					5.3	5.3	5.3	5.3	5.3	
Egypt SEGAS II	EGPC, Union Fenosa, Eni, BP								5.3	5.3	
Equatorial Guinea	Marathon							0.2	4.0	4.0	
Snoevhit	Statoil, TOTAL, GdF								4.2	4.2	
Sakhalin	Shell, Mitsubishi, Mitsui							1.0	9.6	9.6	
Tangguh	BP, Mitsubishi, BG							1.0	6.0	10.0	
Iran	NIOC, Reliance, BP									4.0	
Venezuela	Shell, Mitsubishi									8.0	
Gorgon	Chevron/Texaco, Shell, ExxonMobil								5.0	7.5	
Nigeria Brass River	ConocoPhillips, ChevronTexaco								4.0	4.0	
Total Supply		**69.1**	**78.5**	**107.1**	**136.2**	**158.2**	**177.6**	**192.0**	**265.9**	**299.6**	**10%**
Bolivia	*Repsol, BG*								*4.0*	*8.0*	
Peru	*Hunt Oil, PlusPetrol, SK*								*4.0*	*4.0*	
Iran	*NIGEC*									*4.0*	
Indonesia Sulawesi etc	*Pertamina*									*4.0*	
NAGV	*Shell, Woodside*									*4.0*	
North Slope	*BP, Phillips*									*8.0*	
Yemen	*TOTAL*								*2.0*	*5.0*	
Unlikely									*8.0*	*32.0*	

Source: Deutsche Bank

Asia delivers strong sustained growth in LNG demand, led by Taiwan, China and India.

Southern Europe drives forward the European market - with stellar growth from Spain, Portugal, Greece and Turkey.

US gas market shows major expansion in the 2002-2007 timeframe as two terminals reopen. Huge annualised growth. The wave of new LNG regas projects will sustain the growth story.

Overall market growth is strong, even if from a relatively small base.

Asia's market share falls - dramatically. The Atlantic Basin-US market is where the big action is.

Will Indonesia succeed in maintaining its market share as Arun declines? BP's Tangguh is vital.

Shell's Malaysia picks up the market share?

Shell's Nigeria and Oman also huge success stories.

Qatar moves to become the world's biggest LNG player from nothing in 1995 to 60 Mt per year in 2010.

Trinidad is the jewel in BP's LNG crown - huge returns into the US market. Repsol also well exposed.

Best returns are in expansion projects...

Bayu-Undan major success for ConocoPhillips.

Egypt emerges as mjaor new player - BG shows the way. Dominates 2005

Can Marathon take the mid-cap challenge and make Equatorial Guinea work? Market says BG will, but Marathon won't - doesn't make sense...

Supply grows faster than demand, as market moves from excess tightness.

Bolivia referendum great result for Repsol. Now for a choice of export port...

Executive summary

Outlook: developing supply is the challenge

LNG boom? What LNG boom?

Despite huge global gas prices, riding at $5+ per mmbtu ($40 per barrel), there is no major new project starting up this year to supply the global market with LNG. Literally trillions of feet of gas reserves are available at these prices. There is currently considerable spare LNG shipping capacity...but few new developments. LNG market growth of 20%-30% annually is hardly impressive from a base of 4mmboe/d of LNG production – or just 5% of the global oil market (80mmboe/d). Growth this year of around 1mmboe/d in the LNG market is just half the growth of the oil market in absolute energy terms. Boom? What boom?

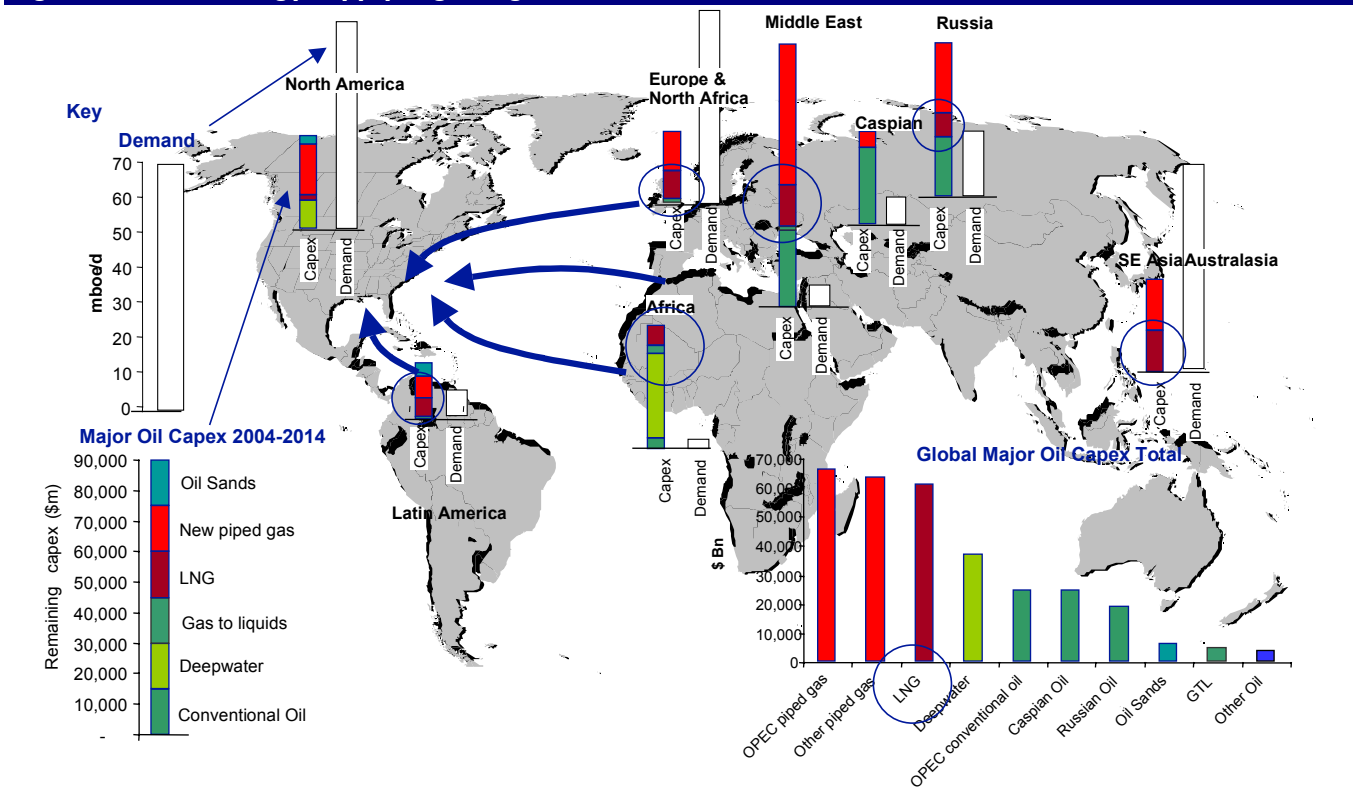
Exploding the myths

The most widely held misconception is that there is a problem with US regasification capacity – there is not. The four existing terminals have yet to sell out. LNG is safe and the public in the Gulf Coast of the US supports its development. Neither currently, nor longer term, do we see a significant issue with access to the US gas market. Rather, the terminals are extremely expensive, and to lower unit costs, have to be extremely large.

Developing supply is the challenge. Several permitted regas terminals are slated at 1.5bcf/d of capacity (250kboe/d), which would require huge LNG projects to fill; the fastest LNG project expansions – e.g. Nigeria LNG – took six years from first delivery to reach that scale. To extend the example, prior to first delivery, the Nigerian project was 30 (thirty) years in development between gas discovery and first LNG. This is because there are multiple partners and developing governments to convince, multi-year planning and construction cycles...and potentially, based on planned start-ups, everybody will start attempting to build simultaneously.

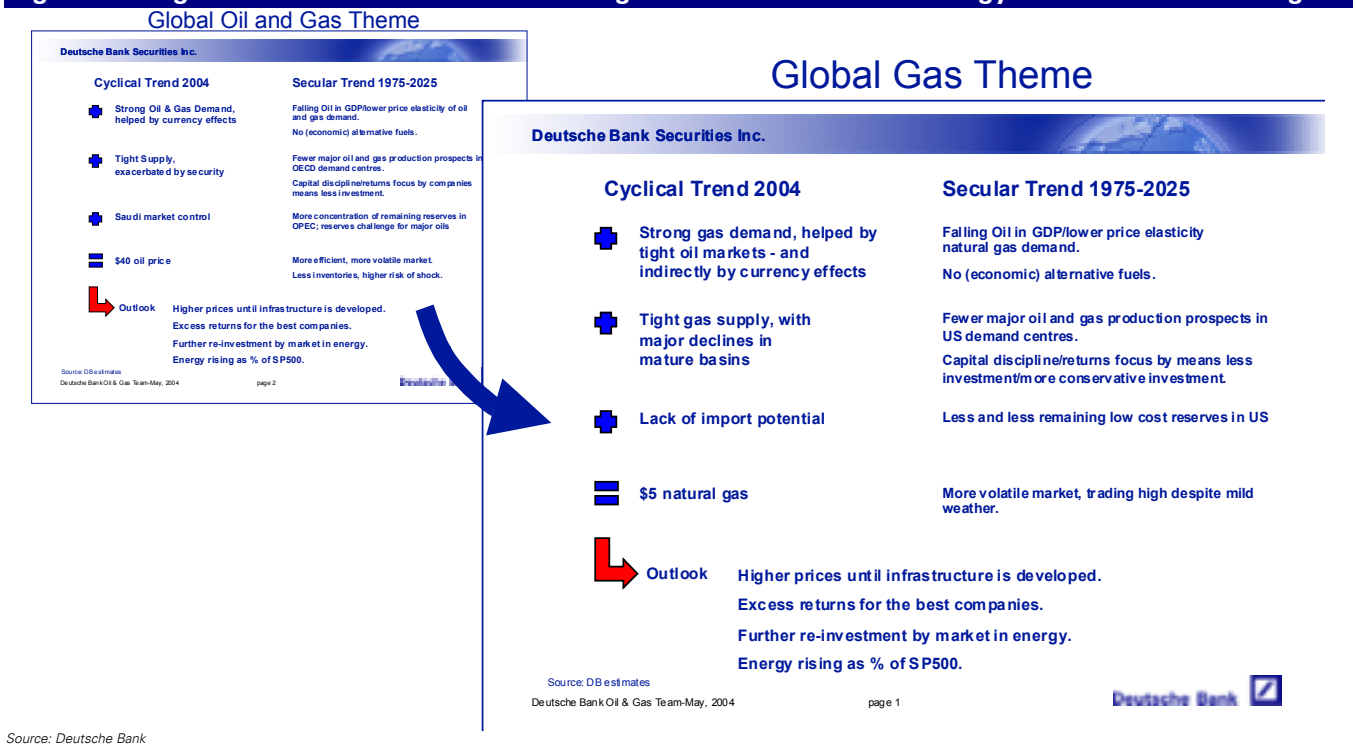
The LNG challenge fits our key overall oil and gas theme: the globe is under-invested in the infrastructure required to meet strong demand for oil and gas. OECD (ie North American and European) oil and gas is in secular decline. Replacement energy is distant and requires huge development expenditure. US gas and the LNG challenge is the most obvious, and largest, of these challenges.

Figure 2: Global energy supply is getting more distant; more OPEC; riskier



Source: Deutsche Bank

Figure 3: US gas and the need for LNG is the largest and clearest of our energy infrastructure challenges



Source: Deutsche Bank

The winners: companies that can begin to meet the market's needs

Between now and the development of sufficient LNG supply to meet the need for gas in the US, natural gas prices will be high. This is a five-year period at least. Companies that can meet the *current* market's needs are winners.[1]

- **US E&Ps with good growth and contained costs:** Our US E&P team highlights the following companies with strong leverage to higher gas prices: EOG (Buy, PT $57); XTO (Buy, PT $32) and Devon (DVN, Buy, PT $64).
- **Early-moving LNG suppliers that are now successfully supplying gas:** Several European companies are in this position owing to their moves over the *past* five years – RD/Shell (RD.N, PT $57, Buy), BP (BP.N, PT $53, Hold), BG (BG.L, PT 340p, Hold), TOTAL (TOT.N, PT $105, Buy) and Repsol (REP.N, PT $25, Buy).
- **Companies that are moving now to develop mid-term supply:** Here we cite Marathon (MRO, PT $40, Buy). ConocoPhillips (COP, PT $82, Hold) has a major start up at Bayu Undan by 2006. ExxonMobil (XOM, PT $46, Buy), leveraging the huge low cost potential of Qatar, is aggressively moving to dominate a global business with no anti-trust issues. ChevronTexaco (CVX, PT $99, Buy) has the highest potential risk/reward in LNG, with plenty of opportunity but little *concrete* progress to date.
- **Developers:** The basic thesis that LNG projects need major investment is good for developers, such as Halliburton (HAL, PT $40, Buy) Technip (TECF.PA, PT Euro 130, Buy) and Chiyoda (6366.T, PT ¥750, Buy). Chemical company Air Products (APD, PT $60, Buy) also fits this theme.

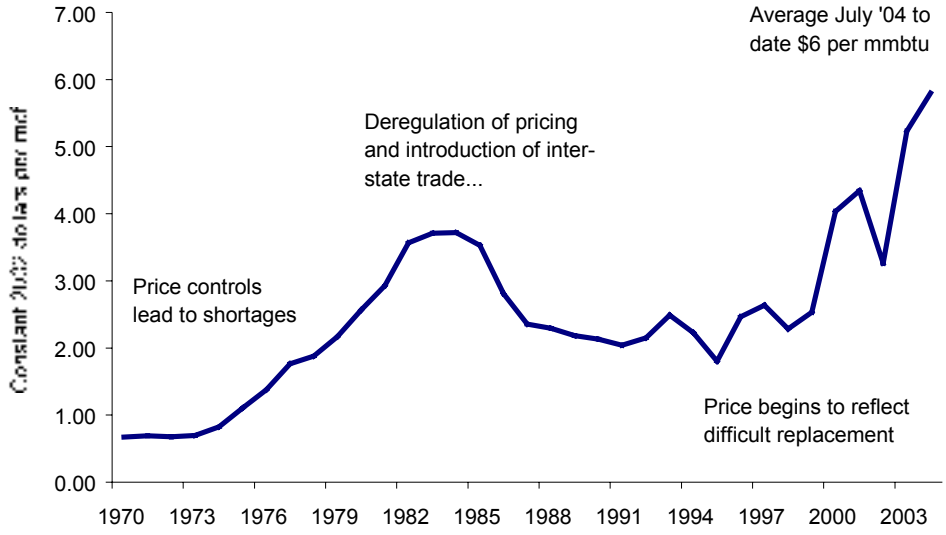
Valuation

Supply is not available on the scale required to seriously dent the high price environment

Point 1: There is a myth that LNG threatens the US gas price in the medium term. It does not. Supply is not available on the scale required to seriously dent the high price environment that is borne from strong demand and the ongoing declines in supply in the US gas market. Weather may alter the seasonal picture on a short term-cyclical basis, but the secular trend towards higher US gas prices is undeniable. In the medium term, the picture is positive for the earnings of US E&Ps and US-oriented service companies.

[1] Share prices for recommended companies as of the close, Tuesday, 20 July:
US E&Ps: EOG $62.80, XTO, $29.15, DVN $69.64
European oils: RD $51.96, BP $55.43, BG 347.5p, REP $22.40
US oils: MRO $37.57, COP $79.28, XOM $45.90, CVX $94.77
Service/chemical companies: HAL $31.43, TECF.PA EUR 111.8, 6366.T ¥718, APD $51.62

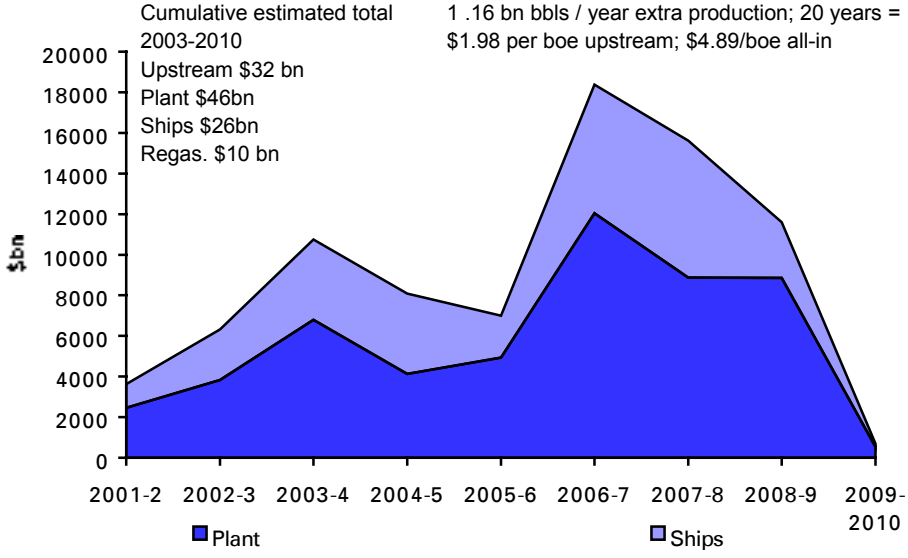
Figure 4: Real US gas prices: rising



Source: DOE, World Bank

Point 2: with LNG deliverable globally at $3 per mmbtu, the higher US gas price represents a huge opportunity that companies will rush to fill. We reiterate our longstanding forecast of major increases in LNG capital spending over the coming years (and decades). Companies exposed to this are: Halliburton; Technip; Chiyoda and Air Products (all BUYS). Additional plays on the theme are Saipem (SPMI.MI, Hold, EUR 7.6) and Chicago Bridge and Iron (CBI, not rated), as well as Daewoo Shipbuilding (062660.KS, Not Rated).

Figure 5: Estimated Capex in global LNG 2001-2010

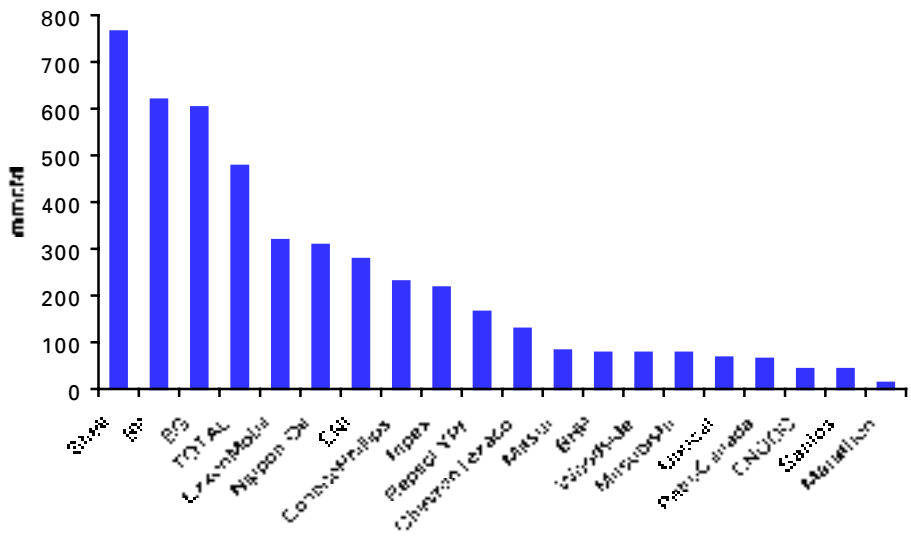


Source: Deutsche Bank

Euphoria over some of the lower return elements over the business may be overstated. We deny the sustained potential for a major traded spot market in LNG and consider the "LNG Chain" of contracts to be strengthening and tightening as projects become bigger, more capital intensive, and therefore more bound by contractual links. If the speculative, or spot, market was really here, surely one of the permissioned US LNG regasification greenfield projects would have started construction – they have not.

Certain LNG-exposed companies will make no more money from higher gas prices, and will be threatened by rapid growth, as they are essentially utility businesses. These are LNG shippers (e.g. Golar LNG, not rated and Teekay Shipping, not rated) and LNG regasification plays (Cheniere, not rated). However, these companies may be attractive take-out candidates within the theme of more tightly integrated contractual chains, for example if ExxonMobil needs a quick fix to its lack of US regasification capacity or if organic development proves too time-consuming and frustrating.

Figure 6: Growth in gas into LNG production, 2003-07E



Source: Deutsche Bank

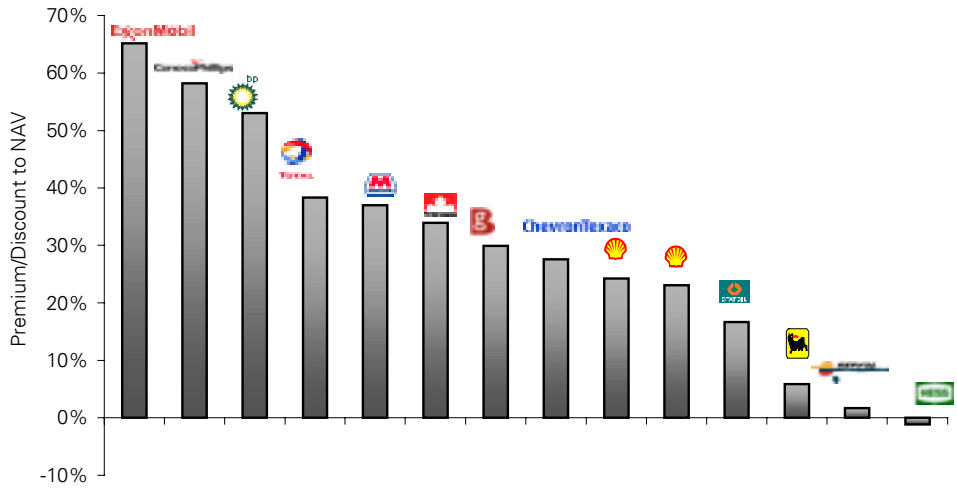
Among the conventional gas producers, where the highest returns and highest leverage to higher gas prices are to be found, the relative growth is with the traditionally dominant plays, Shell, BP, BG, TOTAL, ExxonMobil, Eni and ConocoPhillips. These companies have invested heavily over the past five years and should now reap the rewards. Based on valuation, we currently have Buy recommendations on Shell, TOTAL, and ExxonMobil.

Risks: project development and management

Mismanagement could lead to enormous value destruction

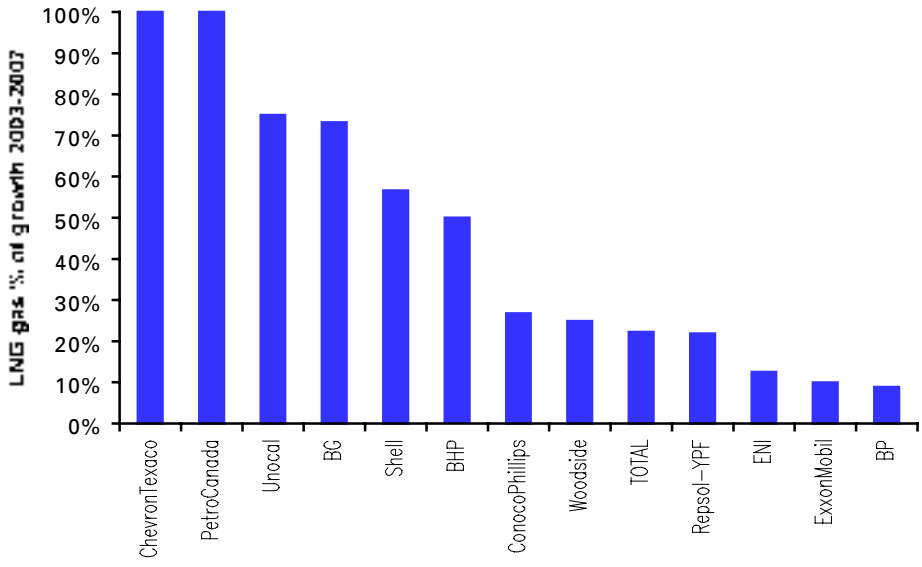
Companies need to invest billions and must successfully manage the process to avoid enormous value destruction. Projects are in risky places, either technically, such as the extreme Northerly Barents Sea for Statoil's Snoevhit; politically, such as Angola or the Middle East (Qatar); or from a labour dispute point of view, such as Trinidad. Companies that mismanage projects in development and operation can literally cost shareholders billions. Investors must be convinced that they are entrusting their money to top quality managements, or be rewarded with an appropriately risked entry price. Unable, as we are, to judge managements objectively ourselves (at least in print) we point to NAV premium/discount as *de facto,* as a representation of future re-investment skill, the markets' valuation of management quality.

Figure 7: NAV premium/discount – market view of management quality



Source: Deutsche Bank, companies shown only integrated majors with LNG project exposure

Figure 8: Who needs LNG? Relative exposure to growth from LNG

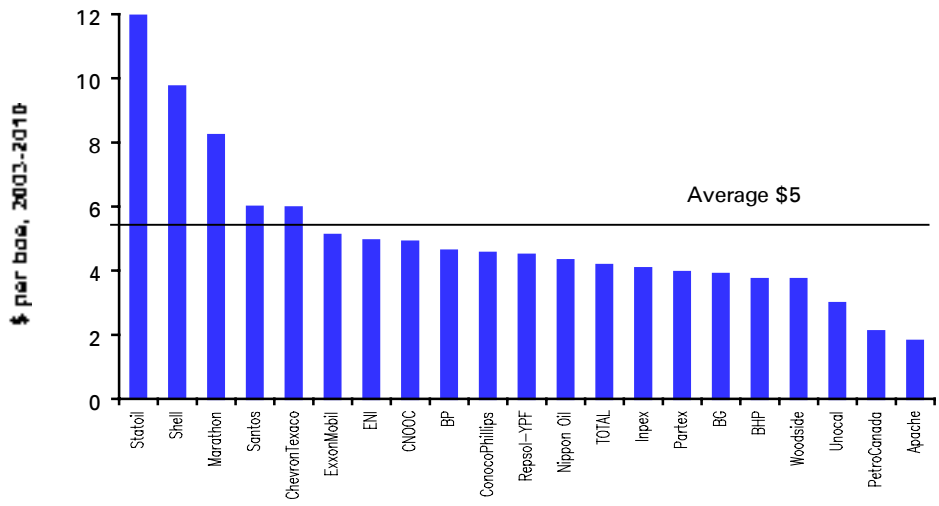


Source: Deutsche Bank

Who *needs* LNG? Companies with LNG growth and little other volume growth drivers are the more leveraged to LNG as above – ChevronTexaco and PetroCanada reveal themselves to be dependent on LNG for providing any kind of growth. Eni, BP and ExxonMobil are notable for having high levels of LNG growth in absolute terms that do not dominate their overall growth profiles.

An alternative risk calculation is capex per boe of production. Of course, this is problematic because pure boe production numbers do not capture returns on capital expenditure, nor investment this decade for growth next. Nevertheless, a first glance of approximate capex dollars per boe of additional production 2003-2010 throws up some interesting exposure to relatively high levels of capex for relatively little production over the next 10 years, particularly for Statoil and Shell. However, we stress that current pressure on book returns is likely to lead to longer-term high free cashflow as LNG drives gas delivery in the 21st Century. In other words, high capex for the next decade is not *necessarily* a bad thing, assuming projects are on time, on budget and perform with long lives. However, history says the market will pay for growth now, not capex now.

Figure 9: LNG capex per boe of LNG gas production 2003-2010



Source: Deutsche Bank. Capex is upstream and gasficiation plant, but not ships or regasification.

Key corporate picks

Buying into LNG potential – key picks

Top LNG picks:
Halliburton
Technip
Air Products
Shell
TOTAL
ChevronTexaco
Repsol

Kellogg Brown and Root (KBR) is the dominant builder of LNG infrastructure globally, accounting for more than two-thirds of liquefaction capacity additions in the past 20 years. Currently held within the **Halliburton** company (Buy, PT $40), we think KBR could be spun out within the next year. Halliburton currently trades at a 30% discount to rivals Schlumberger and Baker Hughes, and at a major discount to pure play LNG stories such as BG and Chicago Bridge and Iron. Buyers of Halliburton shares gain a rare discount entry to LNG construction growth over the coming decade. Equally, France's **Technip** (Buy, price target Euro 130) is the best value European play on LNG procurement and construction growth.

LNG should be a significant driver of growth in EPS for **Air Products** (Buy, TP $45) between now and 2006. The company's leading position in the LNG heat exchanger market provides derivative exposure to LNG growth. While LNG heat exchangers are a small part of Air Products' operations, LNG growth lifts the Equipment segment profits to an estimated 2%-3% of EPS by 2006, from breakeven in 1H04. Air Products is one of our top picks in the chemical sector.

Australia N.W. Shelf; Brunei ColdGas; Malaysia LNG; Nigeria LNG; Oman LNG; Russia Sakhalin II LNG; Australia Gorgon LNG; Venezuela LNG – no company has a more comprehensive or sizeable spread of LNG exposure than **Shell** (RD.N Buy, PT $47). We have continued to underline the asset base of this giant company as a key rationale for our Buy rating; it is *the* dominant LNG play – with major upstream, plant, shipping, and regas positions. The key project to watch is Sakhalin II, which is currently under development. With a tie-up with **Sempra** to take Russian LNG to the US West Coast, the project looks to be the major greenfield start-up of the next five years. **TOTAL** (Buy, PT $105) also has a very strong global LNG position with exposure to both Asian & Atlantic Basin markets.

Like Shell, **ChevronTexaco** (Buy, PT $99) remains undervalued against the prevailing oil, gas and refining environment – both trade on just 25% premium to NAV at $23 (ExxonMobil trades at 58% premium currently). The challenge for ChevronTexaco is turning its capital recycling programme, of selling down US gas assets to invest in international gas assets, into actual steel, concrete and US LNG supply. To date, the company only has a very large inventory of unsold gas on its books. The next three years will determine whether ChevronTexaco can turn its LNG potential into LNG earnings. Now trading on just 10.6x 2004E earnings, and 7.3x cashflow, we think the market is discounting future failure.

Repsol (Buy, PT Euro 20) is another discount play on LNG potential. The Bolivians have voted "yes" to permitting Pacific LNG exports on the 18 July, and the prospects for this project look better than ever for commercialising Bolivia's 50tcf plus of gas into the high-priced North American market. With some 16tcf net, Repsol is Bolivia's biggest gas reserves holder. We currently value their stake in the base Bolivia Margarita gas project at only Euro 225m - the developing and expanding Trinidad LNG project is in our Repsol NAV at Euro 2bn. With additional exploration in LNG hot spot, Equatorial Guinea, this year, even at our Euro 20 target price, Repsol would trade at just 5.7x 2004E cashflow vs. the European midcaps on 7.1x and Petrobras at 6.3x. Buy.

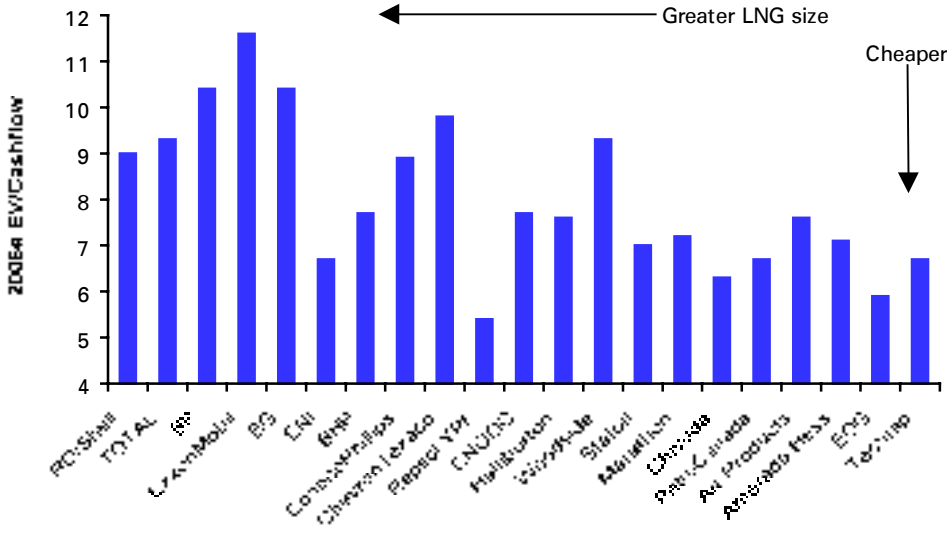
Figure 10: Major LNG companies and valuations

LNG Producers	Ticker	Recommendation	Market Cap.($ Bn)	Net Debt	EV	Est. % LNG 2006*	2004E P/E	2004E CFx	2006E P/E	2006E CFx	Comment
RD/Shell	RD.N	Buy	174.58	14.01	188.58	20%	11.5	7.5	17.2	9.0	Global range of major LNG projects
TOTAL	TOT.N	Buy	122.80	8.40	131.20	22%	12.7	8.2	18.3	9.3	Global range of major LNG projects - smaller stakes than Shell
BP	BP.N	Hold	198.00	15.86	213.86	12%	13.8	8.6	21.3	10.4	Dominant in highly profitable Trinidad. Adding Tangguh, Indonesia
ExxonMobil	XOM.N	Buy	296.90	-2.26	294.65	8%	15.0	10.0	19.9	11.6	Very highly reliant on Qatar - major expansion pre-2010
BG	BG.L	Hold	22.60	0.58	23.18	35%	16.9	9.2	20.5	10.4	The pure LNG play amongst major oils - no refining or chemicals dilution
ENI	E.N	Hold	77.90	13.32	91.22	8%	12.0	6.6	12.6	6.7	Strong upstream, also service leverage through Saipem and Snamprogetti
ConocoPhillips	COP.N	Hold	54.20	13.48	67.68	6%	8.8	6.5	18.5	8.9	New growth with Bayu Undan, aggressive position on US regas
ChevronTexaco	CVX.N	Buy	96.90	4.10	101.00	4%	10.6	6.8	20.6	9.8	Potential is there, challenge is delivery, first step, Gorgon
Repsol-YPF	REP.N	Buy	27.10	4.88	31.98	10%	9.7	5.2	11.8	5.4	Bolivia referendum result could turn project into major winner
CNOOC	0883.HK	Hold	17.50	-0.12	17.38	15%	11.5	7.4	13.5	7.7	The China play on LNG - partner of choice for China access
Unocal	UCL.N	Hold	10.19	3.25	13.44	18%	13.3	4.9	na	na	Good position at Bontang in Indonesia - leads the US E&Ps
Woodside	WPL.AX	Buy	8.50	0.79	9.29	25%	19.1	11.7	17.5	9.3	Australia's LNG operator
BHP	BHP.AX	Buy	57.60	4.71	62.31	8%	15.3	10.4	10.8	7.7	North West Shelf niche position
Statoil	STL.OL	Hold	27.10	3.16	30.26	6%	11.3	5.8	16.5	7.0	Can costs be controlled at Snoevhit - looks like a major risk
Marathon	MRO.N	Buy	12.50	3.73	16.23	5%	11.2	6.0	14.3	7.2	Equatorial Guinea is now a development challenge - can MRO deliver?
Apache	APA.N	Hold	15.25	2.25	17.50	2%	11.0	4.8	na	na	Egypt position
PetroCanada	PCZ.N	Hold	11.40	2.81	14.21	2%	8.7	5.0	15.3	6.7	Trinidad position
Amerada Hess	AHC.N	Buy	8.30	3.10	11.40	2%	11.6	5.4	23.2	7.1	Small stake in the ballooning costs of Statoil's Snoevhit is worrying
EOG	EOG.N	Buy	7.38	1.19	8.57	2%	16.7	5.9	16.7	5.9	Trinidad position
Service/Chemical Companies											
Halliburton	HAL.N	Buy	13.39	3.02	16.41	15%	35.5	11.8	18.6	7.6	(2005E P/E, EV/EBITDA) Key play is KBR - top LNG constructor
Chiyoda	6366.JP	Buy	1.11	0.00	1.11	40%	16.4	9.1	14.8	6.3	(Fiscal years) Chiyoda highly leveraged to LNG growth
Air Products	APD.N	Buy	11.60	2.40	14.00	2%	19.7	9.2	15.0	7.6	Small but growing element of business
Technip	TECF.PA	Buy	2.21	0.18	2.39	5%	22.1	7.6	54.9	6.7	Benefits from LNG construction growth
Memo, not covered:											
LNG Shippers											
Golar LNG	*GLNG.OL*		*0.97*	*na*	*0.97*	*100%*	*18.4*				*Consensus P/E - pure play on LNG shipping, but spare capacity currently*
Teekay Shipping	*TK.N*		*3.05*	*na*	*3.05*	*20%*	*7.4*				*Consensus P/E - primarily a crude oil shipping play*
LNG Service											
Chicago Bridge and Iron	*CBI.N*		*1.36*	*na*	*1.361*	*60%*	*20.3*				*Consensus P/E - good leveraged play on cryogenic tanks*
Daewoo Shipbuilding	*042660.ks*		*2.14*	*na*	*2.14*	*50%*	*9.7*				*Dominates new build LNG tanker business*
LNG Regas											
Sempra	*SRE.N*		*8.20*	*na*	*8.204*	*5%*	*10.6*				*Consensus P/E - interesting utility play on LNG imports to US*
Cheniere	*LNG.A*		*0.36*	*na*	*0.362*	*100%*	*na*				*Consensus P/E not available - leveraged pure-play with first mover status*

* Estimated % of capital employed for LNG producers, estimated % of order backlog for service companies

Source: Deutsche Bank estimates, company data , Bloomberg

Figure 11: EV/Cashflow 2006E by LNG size



Source: Deutsche Bank estimates

[2] Additional share prices for recommended companies as of the close, Tuesday, 20 July: E.N $103.09, 0883.HK HK$3.65, UCL $38.88, WPL.AX A$17.30, BHP.AX A$12.90, STL.OL NOK 86.3, APA $46.50, PCZ $44.42, AHC $83.19

Global LNG: overview

Technically a simple story. Financially a scale challenge

In characterising LNG as "the oil of the 21st Century" (*LNG: going, going, gone Global*, May 2003), we identified a long-term secular trend based on the abundance of remaining gas reserves, mostly discovered in association with oil (Explorationist comment, "Oh no! It's gas"). Quite simply, in the absence of an economic alternative to oil and gas as the primary fuel of global economic activity, and allowing for the decline in major oil provinces, still-abundant international gas will be the fuel of the 21st Century. The most economic, clean and safe means to transport this international gas is liquefied, in ships, simply because major remaining gas reserves are distant from major current i.e. US and Europe, and future i.e. Asia, gas markets. Pipeline economics collapse relative to LNG over long distances.

Figure 12: LNG, easy as $1bn, $2bn, $3bn

No change in chemical make up of gas - simply (almost) pure methane chilled and then re-heated

Conventional "Upstream"

Supplies gas - large quantities required. Best projects have large, simple reservoirs, hopefully with associated oil. Approx. ~3 tcf of gas required for a 3 Mt 20 year project = 300 mmcfd delivered

Same process as gas production for pipelines.

Liquefaction - a giant fridge

Using the same technology as a refrigerator - just on a giant scale, a "train" takes 450 mmcfd of gas to produce 3 Mt of super-cooled gas liquefied at -160 degrees, and reduced in volume by 1/600

Shipping - a giant thermos

Liquid is pumped onto a ship, confusingly scale is measured here in cubic metres - gas is a nightmare when it comes to unit conversions. Typical ship is 135,000 m3 and delivers 2.85 bcf of gas. Note this is around 1/4 the size of energy delivery of a super tanker of oil (2 mbbls of oil, vs 0.4 mbbls o.e. of LNG).

Re-gas - a nozzle

Regasfication is the most basic part. The ship is attached to the storage tanks and offloaded. The liquid gas will boil naturally back to gaseous form. This is also the safest part of the process.

Source: Deutsche Bank, Wood Mackenzie.

However, the capital intensity of LNG is such that while costs have been driven down, the overall investment required for a 5Mt per annum LNG train is around $5bn, which delivers just 500mmcfd of gas – around 1% of the US market for gas. The global energy industry faces a vast investment requirement.

The quantities delivered for such an investment in LNG are considerably less than the equivalent delivery of oil, and a simple conclusion is that if LNG is to be the oil of the 21st Century, then global energy costs, and capital employed in energy, must rise.

A major investment, but returns are good...eventually

Will returns suffer? Yes and no. In the short term it is clear that the major LNG investment is dilutive to book returns, simply because of the large up-front capex that is required. It is important to note that current capex outlines for major oil companies are basically ex-LNG. ExxonMobil, ChevronTexaco and ConocoPhillips all advise that current capex guidelines do not include the potential for further major, lumpy, LNG investment. For example, if ChevronTexaco succeeds in progressing Angola LNG and Port Pelican regas, which would like be a simultaneous process, then annual capex will be as much as $1bn, or approximately 15% higher than current guidance.

To complicate returns further, there is the different financial nature of different projects. Key amongst these is the potential for project finance to take investments off balance sheet. Equally, when oil markets were very low and Russia was making debt very expensive, Shell financed Nigeria LNG with equity. Qatari trains have been financed with bonds. BG has made aggressive use of off-balance sheet financing. To add to the difficulty in making generalisations, different projects make their return in different parts of the chain - be it upstream, plant, or shipping.

However, broadly speaking:

1) Returns are around 12% IRR.

Figure 13: LNG: indicated returns through the chain. Producing the gas is generally most profitable

	Upstream	Liquefaction	Shipping	Re-gas	Total
		← Returns are being impacted by difficulties in getting investments off the balance sheet →			
"Typical" Investment (5 Mt project)	US$1bn (29.7%)	US$1.25bn (37%)	US$0.8bn (23.7%)	US$0.325bn (9.6%)	*US$3.375bn (100%)*
"Typical" Return	15-**20%** or above	8-**12%** if "tolling" 10-20% otherwise	8-**10%**	8-**10%**	*13.7%*
	Players trade-off upstream and liquefaction returns depending upon project specifics		"Utility businesses"		*(weighted average)*

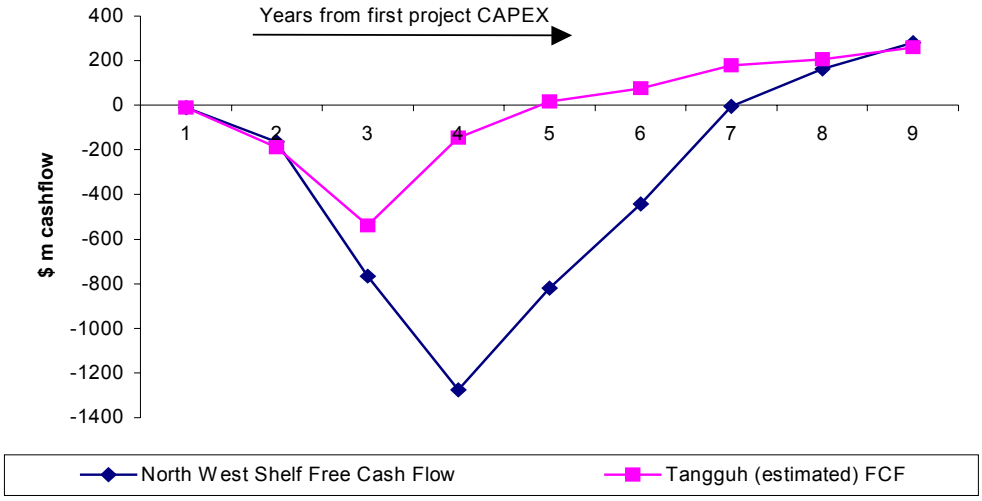
BG typically quotes an integrated return of 12-13% from its LNG business

Source: Wood Mackenzie, Deutsche Bank

2) Returns are destroyed by project delays. With the amount of capital expenditure involved in LNG, it is vital to get free cashflow flowing as fast as possible in order to enhance returns. Delays to projects, which occur frequently, will destroy returns. The ability of company management to successfully develop projects on time and on budget is absolutely vital.

Note, delays to the commencement of first spending on a project are more or less irrelevant to returns, as most LNG gas has long since been discovered and the exploration expense is very small compared to overall project costs. The key is to manage spending and development from the moment of first real capital expenditure – ie project management. The experience of Canadian oil sands projects says that a sudden rush of expenditure into a particular global energy theme causes considerable delays and horrendous cost over-runs. There is clearly a danger of this occurring in global LNG, and it underlines our view that supply remains tight.

Figure 14: Project management is vital to avoid value destruction

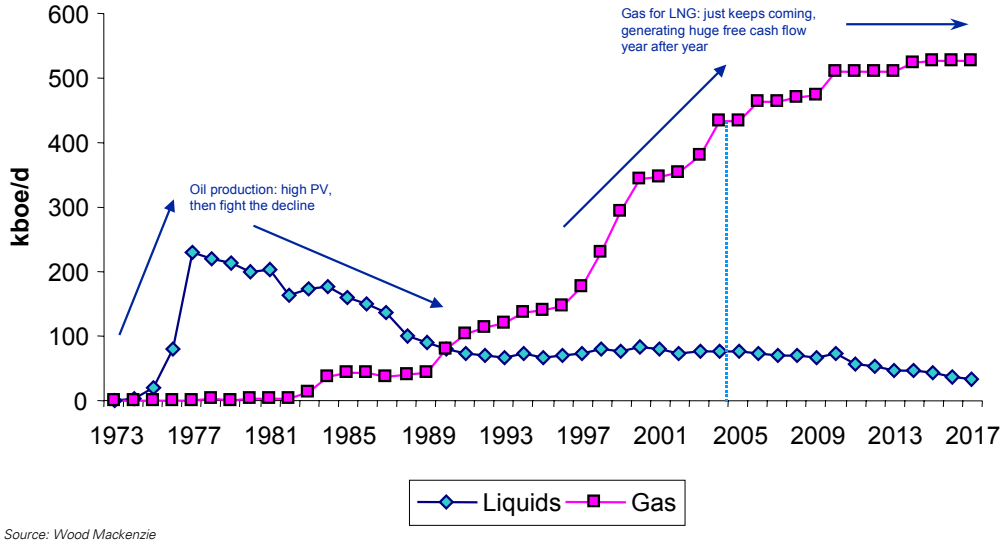


Source: Wood Mackenzie, Deutsche Bank

3) However, if successfully developed, the long-lived nature of LNG projects makes them free cashflow machines once they are built. (see [Figure 13]). Furthermore, most 12% returns calculations are based on fairly aggressive discount rates (i.e. 10%). Reducing discount rates, given the length of time (20 years plus) that an LNG plant is operational, makes returns look even more attractive.

Why do discount rates matter? Because LNG plants are built on top of huge gas reserves. They go on and on (of global LNG plants built since 1968, only Arun has gone into decline, and gas was flared in large quantities for many years there). In the example given in Figure 13, TOTAL's production at Bontang in Indonesia is comfortably sustainable through 2050, long after the plant is fully depreciated.

Figure 15: Example: oil and gas production at TOTAL's Bontang LNG plant

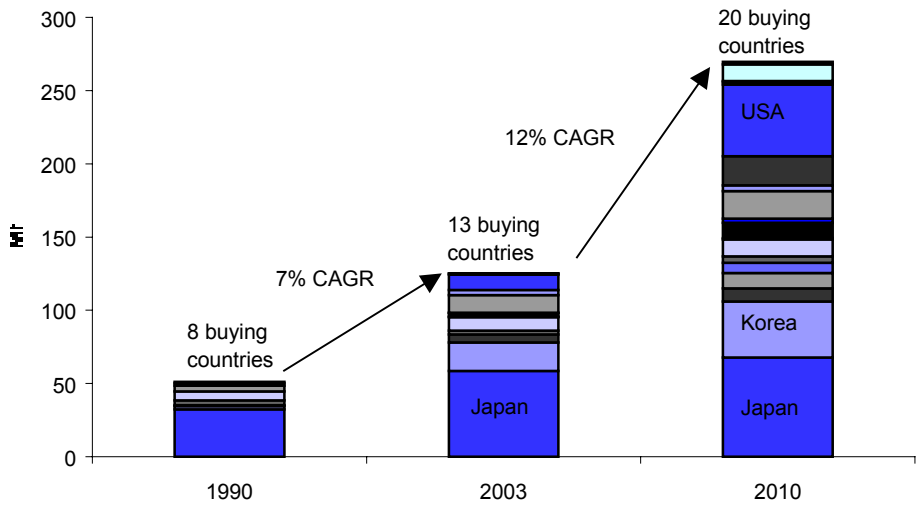


Source: Wood Mackenzie

Demand + returns = growth is strong...from a low base

The LNG market is growing fast, from a low base. As global gas prices have increased, LNG unit costs have declined. The result is strong expansion for LNG demand, from an increasing number of markets.

Figure 16: Market is growing fast and fragmenting



Source: Deutsche Bank estimates

Last year we highlighted the fact that the gas price has now globalised owing to the influence of LNG, whereby the Japanese nuclear crisis, in a chain reaction, reduced the available quantity of LNG for delivery to the US (*LNG: Going...going...gone global,* May 2003). Equally, based purely on available reserves and its relatively clean characteristics as a fuel, we described LNG as "the oil of the 21st Century." Needless to say nothing has changed in a year to alter that view.

In fact, the problem for LNG is meeting near-term expectations. The modern era of globally traded LNG has coincided with a global shortage of gas (and oil) that has left prices in all markets much higher than the ultimate global clearing price of LNG, which we take to be the price of LNG delivered from Qatar. In a piece of geographic elegance, the distance from Qatar to the *East* Coast USA is equal to that from Qatar to the *West* Coast of the USA (think global). Qatar is the location of the huge North Field, the largest known gas field in the world, at around one quadrillion feet of gas (one thousand trillion = one quadrillion), or around 50 years of US natural gas consumption. For 2008 delivery, ExxonMobil claims it can deliver gas from its Qatari expansion projects to any gas market globally for $3 per mmbtu, for a ~15% return.

Figure 17: LNG markets by type and growth (LNG volumes consumed 2003–2010)

Energy Short, Mature	'03 - '10	Energy Short, Growth	'03 - '10	Decline Replacement, Mature	'03 - '10	Coal Replacement, Growth	'03 - '10
Japan	58 - 68 Mt	South Korea	19 - 38 Mt	East Coast US	5 - 15 Mt	China	0 - 7 Mt
		Taiwan	6 - 9 Mt	Gulf Coast US	10 - 30 Mt	India	0 - 10 Mt
Italy	2 - 10 Mt						
France	9 - 12 Mt	Spain	12 - 18 Mt	UK	0 - 20 Mt		
Belgium	2 - 4 Mt	Portugal	0.2 - 3 Mt				
		Greece	0.4 - 1 Mt				
California	0 - 5 Mt	Turkey	3 - 4 Mt				
Boston	2 - 3 Mt						
		Island markets:					
		Puerto Rico	0.5 - 1.5 Mt				
		Dominic. R.	0.2 - 0.7 Mt				
		Shouldn't be importing gas:					
		Mexico	0 - 11 Mt				

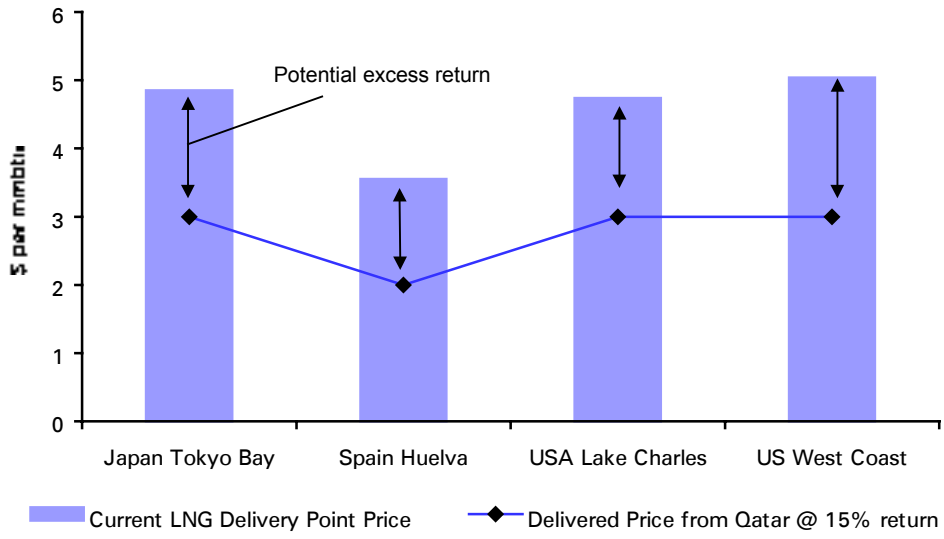
Total Global Market Growth 2003: 125 Mt, 2010: 270 Mt = 12% CAGR

2003 ~17 bcf/d, ~4 mb/d), 2010 (37 bcf/d ~8 mb/d)

Source: Deutsche Bank

For example, the key LNG pricing points from an intra-LNG global trade perspective will be Tokyo Bay; Huelva in Spain; Lake Charles in the US; and potentially, Baja Mexico for California supply (think global). Allowing for the relative proximity of Spain, LNG is currently an outstanding investment proposition. If Qatar makes 15% at $3 gas, then current returns, depending on the precise nature of the upside profit split, would be extremely large – say post tax 30%-40% into any of the three global pricing points (adding $2 to netback prices takes pre-tax returns to 50%+). Even ignoring upside against current prices, the base case 15% IRR is in itself an extremely good return on the $5bn cost of an LNG project, in this era of 4% bond yields.

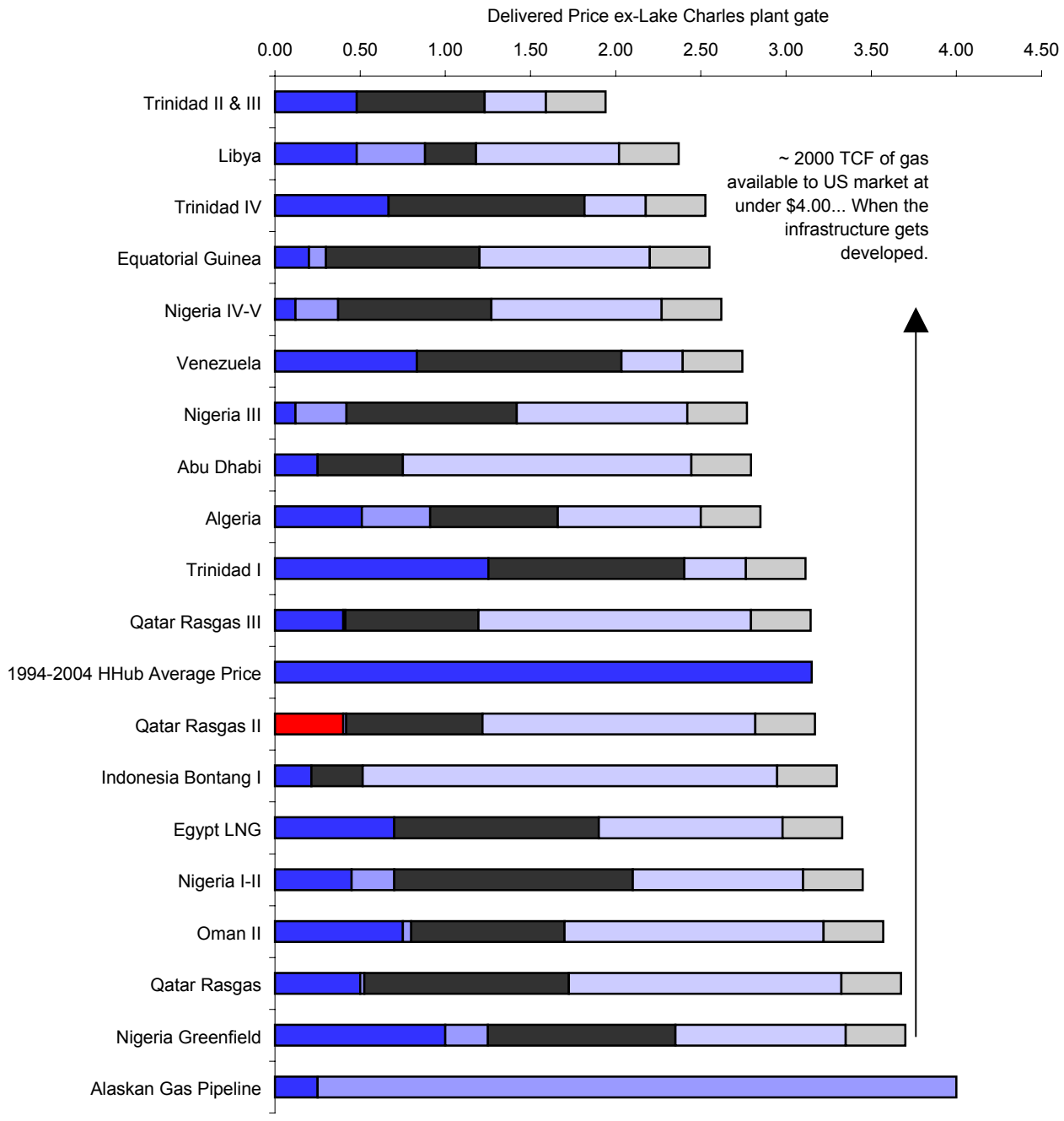
Figure 18: How Qatar would compete today – if the capacity was available



Source: Deutsche Bank estimates., Gas Matters , IEA, DOE

So, as in other areas of the energy market, the prevailing price of oil and gas now wildly exceeds the planning assumptions of the companies, and there is an overpowering economic rationale for building additional LNG capacity. This is even more so the case in the US, where there are few alternative gas supplies to meet the scale of the demand challenge. LNG is clearly the long-term US gas solution.

Figure 19: LNG cost stack for delivery to the US Gulf: huge quantities at competitive prices



Source: Deutsche Bank. Alaskan Gas P(ipeline cost is based on transport from Prudhoe Bay to Chicago

The most obvious manifestation of this is the welter of US regasification projects that are being swiftly progressed through the US permitting process. Equally, a similar market, the UK, now has a similar rush to add capacity. However, the development in regasficiation is actually the first, rather than the last part of the chain. Effectively this is establishing a market for the gas. Some companies are planning regasification terminals well ahead of their ability to supply their own LNG – the current tightness in global LNG supply suggests they will not find it easy to fill their terminals if they do indeed go ahead.

The US experience of Sempra is telling. The company successfully won the permits some time ago to build a major LNG regasification terminal in Louisiana, with few if any local opposition issues, and became the first company to have the right to add new regasification capacity to the US gas market. Since then, nothing has happened. No supply.

Furthermore, the expense of the terminals means they will not be built without supply – a company committing to a speculative LNG terminal would be taking a horrible risk on $600m of investment that at best will earn a utility return. The chain in LNG is stronger than ever – it is a capital commitment chain.

So, given the economic rationale and the scale of the opportunity, there is no shortage of LNG project concepts *per se*. However, actual physical development is not enormously high, when considered, for example, against activity in global oil. Global oil and gas demand both grew at around 2% last year, which in the light of the far greater size of the global oil market (whereby absolute growth in oil demand, at ~1.5mmb/d in 2003 was three times greater, than gas, at ~0.5mmb/d). Furthermore, the natural declines in oil, which are far less of an issue for gas production (ex-US and North Sea), present a picture of a global gas market that is not developing as fast as a prediction made five years ago would have foretold.

Given the economic arguments, the inter-related questions become

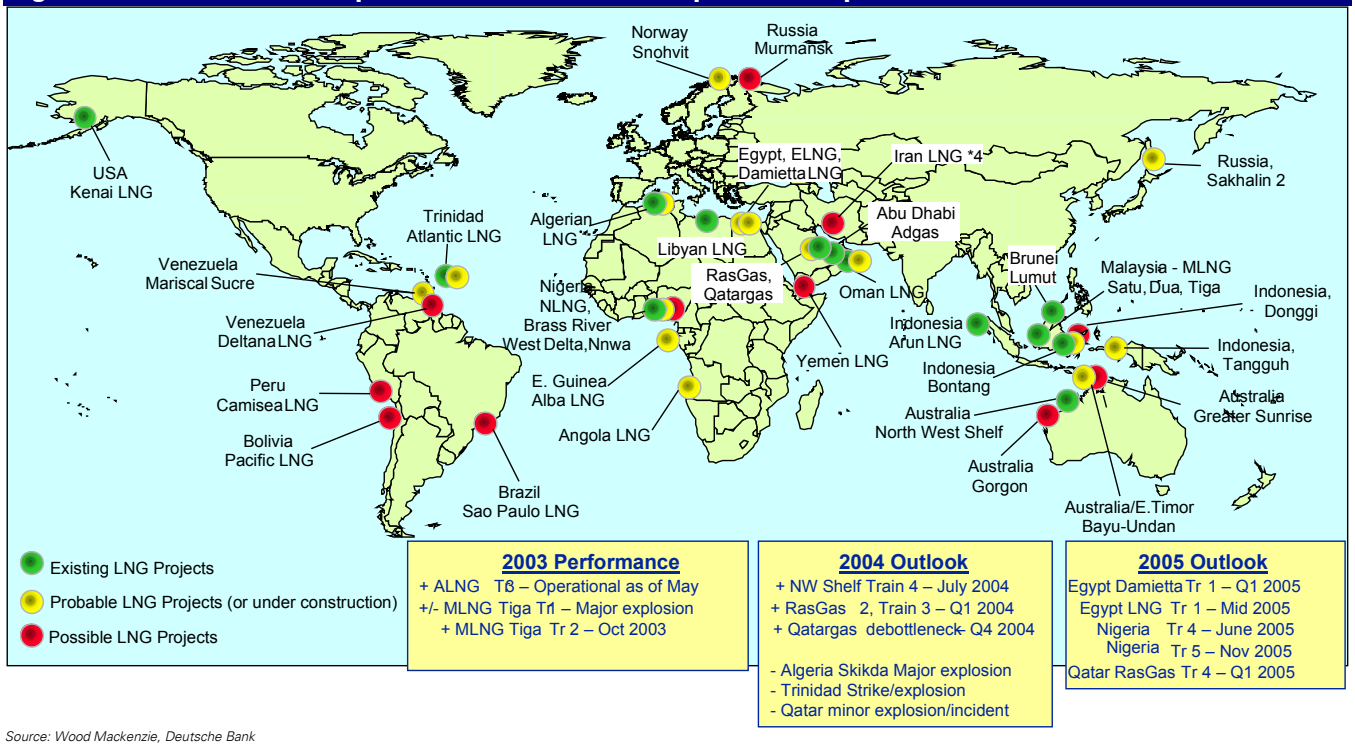
1. Why there is not more LNG being developed currently?

2. Can the potential rush of LNG projects really be simultaneously developed?

Why is there not more LNG growth?

The lack of near-term supply in LNG is a function of the complexity and size of putting together a LNG project. There is a large inventory of projects under development.

Figure 20: Global LNG: 12 operations; 15 under development; 12+ possibles



Source: Wood Mackenzie, Deutsche Bank

However, historically the industry has peaked at the addition of around four trains per year, averaging nearer two. This has represented a global LNG market growing at around 6Mt per year in the past decade. Growth in 2004 is expected by Deutsche Bank to double this rate, at around 12Mt.

As we have highlighted, there is a myth, actually being propounded by companies as well as less-informed investors, that you can build the regasification terminal and the supply will come (for "exploding myths" see below). In fact, the supply is the relatively expensive and tricky part – lobster fishermen in Maine are no less challenging than lobster fishermen in Angola – albeit for different reasons, and the investment in Angola is much larger.

Figure 21: Costs and efforts are dominated by supply of gas, not regasification, which is the *easy* bit

The LNG business is basic but extremely expensive - 5 Mt "single train" plant

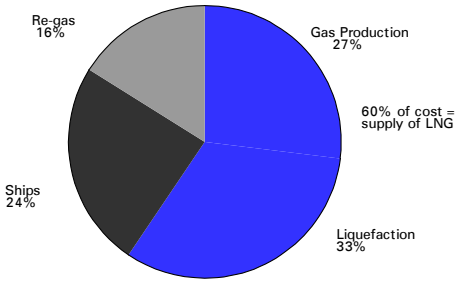
Upstream
5 Mt * $200 per tonne capacity =
US$1000 Bn

Liquefaction
5 Mt * $250 per tonne capacity =
US$1250 Bn

Shipping
5 ships * $180 m per ship =
US$900mn

Re-gas
US$50m per 100 mmcfd of capacity =
$600 m

A generic "greenfield", integrated 5 Mt LNG project has a capital cost of ~US$3.75bn



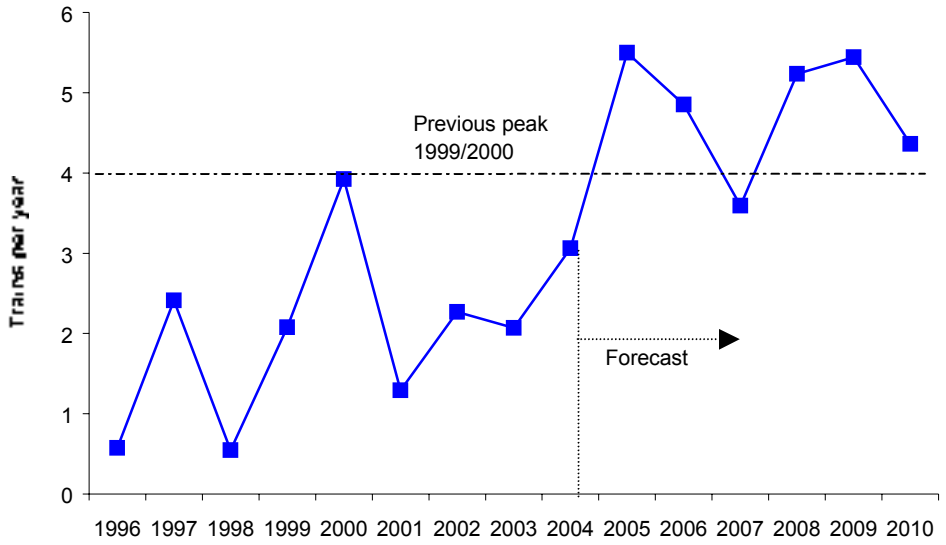
$5 bn = ~ 0.5 bcf/d of gas delivery.

US market ~60 bcf/d

Source: Wood Mackenzie, Deutsche Bank

How fast can the supply grow? One of the interesting data points for future commitments to build LNG gasification plants comes from Air Products, which dominates the market for heat exchanger technology and the heat exchangers necessary to build LNG gasification. Until recently, the company has seen surprisingly little new order action given the implied requirement for new plant – although this is accelerating and is for much larger trains.

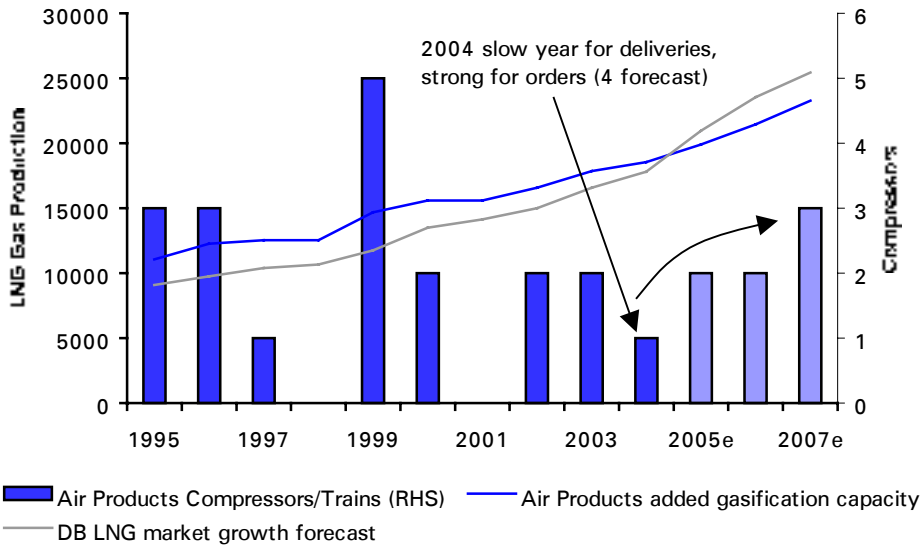
Figure 22: Annual capacity additions in global LNG



Source: Deutsche Bank estimates

The build time on Air Products' compressors is approximately 18 months. From that point it takes one to two months to ship the compressors and then around 12 months to install at the site, and will then need further work. On balance, between an order and first LNG is around three years at best. The fact is that 2004 comes as a lull in deliveries.

Figure 23: Air Products' trains built per year, supply created per year

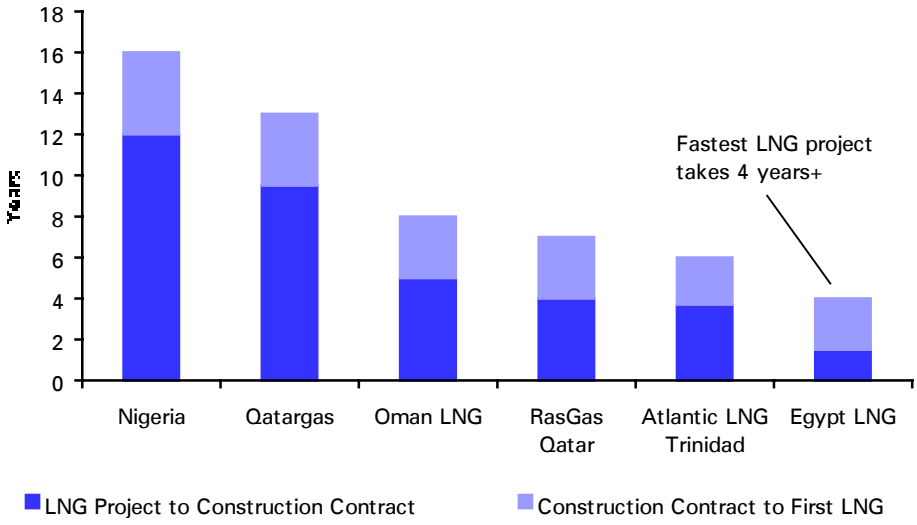


Source: Air Products, Deutsche Bank

Air Products' peak performance was seven heat exchangers in a year, notionally a huge addition of some 42Mt of LNG in a given year for the new, super-large trains that are being developed by ExxonMobil at QatarGas II, for UK and US-oriented LNG projects. In fact, the company expects a large number of orders this year, four, for larger trains that will start up around 2009. However, there is no mistaking from the order book that we are currently suffering from a fairly muted number of orders between 2000 and 2003.

Of course, the Air Products experience is just one part of a complex set of developments. The very fastest developments now take around four years from decision to invest to first LNG, assuming they are delivered on time. We can be comfortable in our forecast for 2008 LNG delivery, as we have established the order book. There are no projects beneath our radar screen that will suddenly appear – it cannot be done. We have based our outlook for LNG supply on this background information.

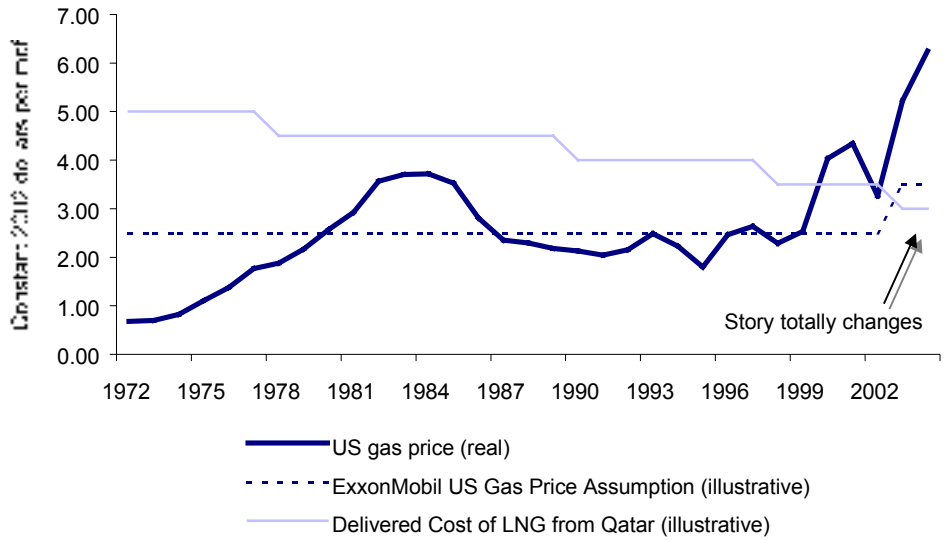
Figure 24: Speed of development in global LNG: better but a long term process



Source: BG

The length of time to develop LNG has combined with the overhang from the 1998/99 oil price crash and global oil industry consolidation. From a Major Oil company perspective, the reason for the relatively limited number of orders is partly a function of their five-year planning horizons. These mean that the oil price crash of 1998/99 and the low gas prices seen in the US market prior to 2000 are only just becoming discounted from the planning process. For example, only recently have we seen the super-major oils, which drive LNG development, move their planning assumptions from the $16 range to the $20 range, regardless of the $40 oil price.

Figure 25: ExxonMobil's US LNG switch



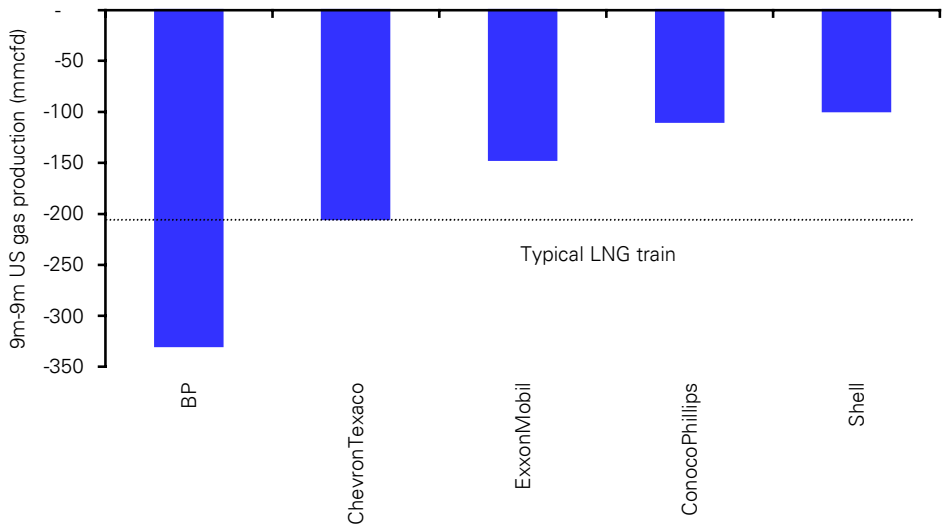
Source: DOE< Deutsche Ban estimates

While ExxonMobil does not publish an oil price planning assumption as such, it *has* publicly raised its assumption for the US gas price, to ~$3.50 per mmbtu. The effect on commitment to LNG projects to serve the US markets is dramatic when combined with the lowered costs at Qatar. Historically a LNG sceptic, Lee Raymond (CEO of ExxonMobil) now leads the industry in terms of planned volumes into the global LNG market.

As a further example, it should be remembered that Trinidad's Atlantic LNG, a relatively recent development, was built with aggressively low costs because it was assumed to be likely to make a loss during the Boston summer low price season. Nobody was planning for today's price to be over $6 per mmbtu.

This underlines our thesis that global oil and gas, particularly US gas, is under-invested. Combined with much lower price elasticity of demand, whereby there is sustained strength in demand despite high prices, we are currently in a phase of higher oil and gas prices, while developments are underway to reverse a sustained period of under-investment since 1998 (see Figure 3).

Figure 26: The need for LNG: only offsetting declines



Source: Company Data, Deutsche Bank

Based on this LNG analysis, there is no ready solution to the shortage of US gas before 2010, given the precipitous decline rates in US gas production. In fact, the developments that are currently planned by ExxonMobil, ChevronTexaco and ConocoPhillips only serve to replace the gas production they will lose over the interim period between today's decline rates and 2009/2010 LNG delivery.

Conclusion: while overwhelmingly an attractive proposition from an economic standpoint, LNG is a major infrastructure challenge that will not be developed in sufficient quantity before 2010 to alleviate the high US, and global, gas price. Growth rates appear high but are from a low base. The grand theory that says LNG is the oil of the 21st Century is intact, but the century is just that, and LNG is being introduced in the decade 2000-2010, which is just the beginning.

Global LNG: exploding the myths

Myths and facts in global LNG

The global oil market will grow by twice as much as the global gas market this year – but LNG is the hot topic. Clearly there is huge potential – however, myths have quickly developed. In this section we discuss some of the key misconceptions surrounding global LNG.

Figure 27: Exploding the myths – US LNG as an example

Myth	Fact
The LNG market is bottle-necked because of a lack of US regasification capacity: safety concerns and "nimbyism" prevent more capacity being added.	**Spare US regasification capacity is under-utilised because of a lack of LNG supply - at any price. Strong government and local support, particularly in the Gulf of Mexico, means there is clearly excess potential regasification capacity.**
Once sufficient ships and regas can be developed to deliver to the US, abundant international LNG is available at $3 per mmbtu.	**There are also currently spare LNG ships looking for supply.**
Already US gas prices are increasingly under pressure from LNG imports up 100% in the past year.	**US gas prices are still well above $5 per mmbtu despite a mild summer. Yet LNG only supplies around 1.5% of US gas demand - and supply is having to come from Australia to achieve that.**

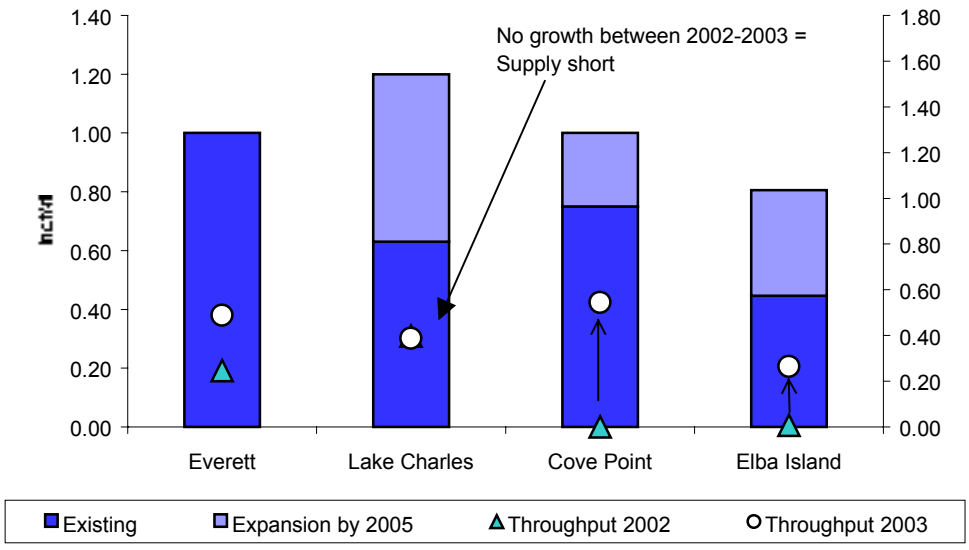
Source: Deutsche Bank estimates

Myth: US regasification is insufficient to meet demand

Fact: there is no shortage of US regas, nor is there likely to be any in the future. This is perhaps the biggest single myth currently propounded regarding LNG: the difficulty seen in adding US regasification capacity, and the idea that this will represent a major bottleneck in the development of the US LNG market.

1. First, currently there is spare capacity in US regasification terminals.

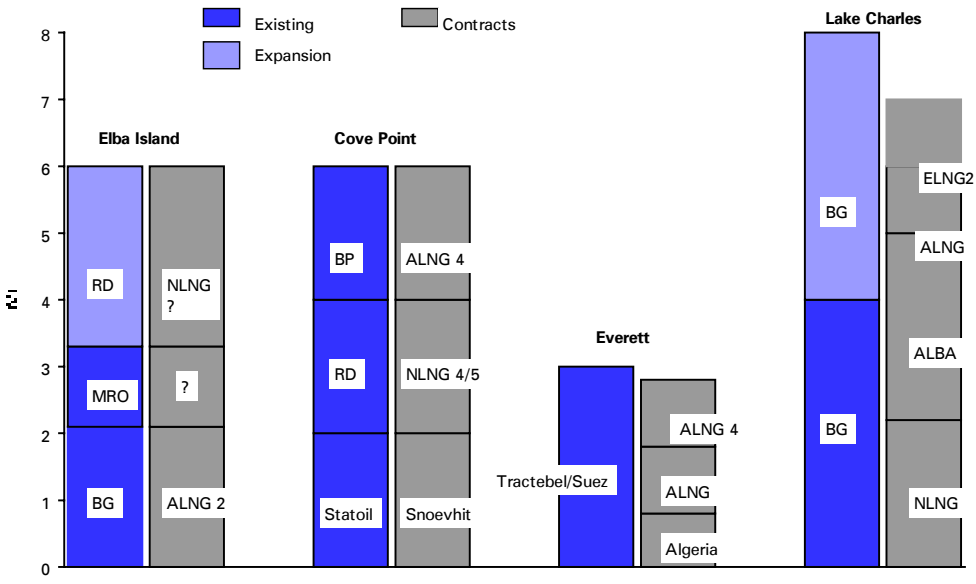
Figure 28: Plenty of spare capacity at existing US regas terminals



Source: Waterborne LNG report, Deutsche Bank

2. Second, even current expansion plans are not filled contractually, with Marathon and BG both holding excess capacity at existing plants. Even ignoring the fact that several major projects are planned without firm supply, existing commitments are not filled. Yet current plans for regasification are seeking to add extremely large quantities of additional capacity, with a further wave of capacity additions in their wake.

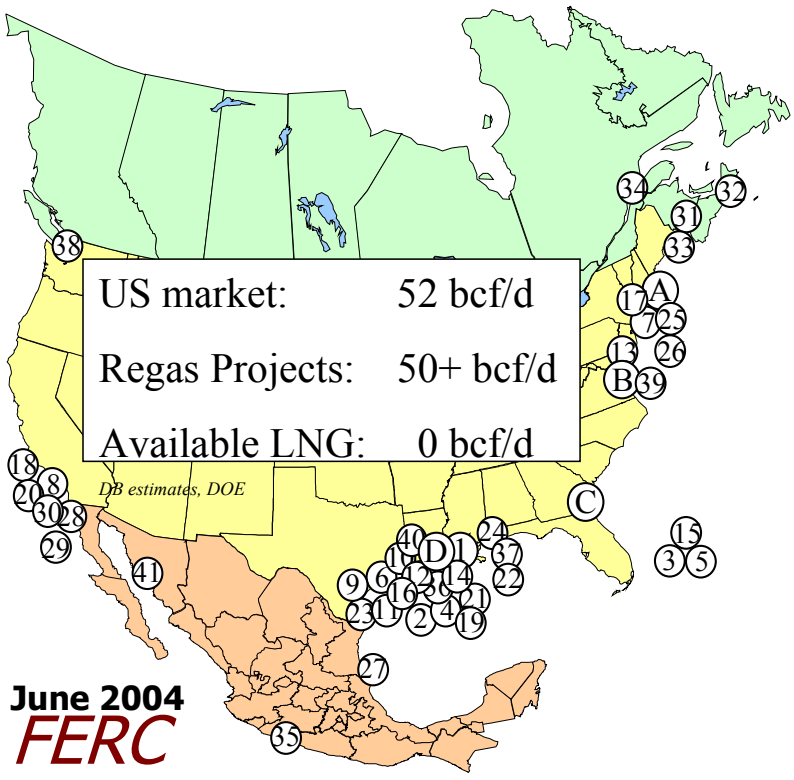
Figure 29: Corporate commitments to US regasification terminals, 2006



Source: Energy Bar Association, Deutsche Bank estimates

3. Third, with support from the highest levels of US government, both the FERC and the Coast Guard have accelerated, and in the case of FERC relaxed, their permitting requirements. Projects are quickly being approved. In fact, there are far too many regasification projects currently being progressed.

Figure 30: FERC's list of current and future regasification plants: shortage? You're kidding...



Existing Terminals with Approved Expansions

A. Everett, MA : 1.035 Bcfd (Tractebel – DOMAC)
B. Cove Point, MD : 1.0 Bcfd (Dominion – Cove Point LNG)
C. Elba Island, GA : 1.2 Bcfd (El Paso – Southern LNG)
D. Lake Charles, LA : 1.2 Bcfd (Southern Union – Trunkline LNG)

Approved Terminals

1. Hackberry, LA : 1.5 Bcfd, (Sempra Energy)
2. Port Pelican: 1.6 Bcfd, (Chevron Texaco)
3. Bahamas : 0.84 Bcfd, (AES Ocean Express)*
4. Gulf of Mexico: 0.5 Bcfd, (El Paso Energy Bridge GOM, LLC)
5. Bahamas : 0.83 Bcfd, (Calypso Tractebel)*

Proposed Terminals and Expansions – FERC

6. Freeport, TX : 1.5 Bcfd, (Cheniere / Freeport LNG Dev.)
7. Fall River, MA : 0.8 Bcfd, (Weaver's Cove Energy)
8. Long Beach, CA : 0.7 Bcfd, (SES/Mitsubishi)
9. Corpus Christi, TX : 2.6 Bcfd, (Cheniere LNG Partners)
10. Sabine, LA : 2.6 Bcfd (Cheniere LNG)
11. Corpus Christi, TX : 1.0 Bcfd (Vista Del Sol/ExxonMobil)
12. Sabine, TX : 1.0 Bcfd (Golden Pass/ExxonMobil)
13. Logan Township, NJ : 1.2 Bcfd (Crown Landing LNG – BP)
14. Lake Charles, LA: 0.6 Bcfd (Southern Union – Trunkline LNG)
15. Bahamas : 0.5 Bcfd, (Seafarer - El Paso/FPL)
16. Corpus Christi, TX: 1.0 Bcfd (Occidental Energy Ventures)
17. Providence, RI : 0.5 Bcfd (Keyspan & BG LNG)

Proposed Terminals – Coast Guard

18. California Offshore: 1.5 Bcfd, (Cabrillo Port – BHP Billiton)
19. Louisiana Offshore : 1.0 Bcfd (Gulf Landing – Shell)
20. So. California Offshore : 0.5 Bcfd, (Crystal Energy)
21. Louisiana Offshore : 1.0 Bcfd (McMoRan Exp.)
22. Gulf of Mexico: n/a (Compass Port - ConocoPhillips)

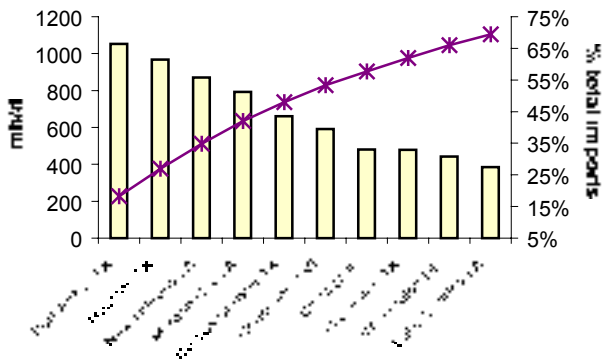
Planned Terminals and Expansions

23. Brownsville, TX : n/a, (Cheniere LNG Partners)
24. Mobile Bay, AL: 1.0 Bcfd, (ExxonMobil)
25. Somerset, MA : 0.65 Bcfd (Somerset LNG)
26. Belmar, NJ Offshore : n/a (El Paso Global)
27. Altamira, Tamulipas : 1.12 Bcfd, (Shell)
28. Baja California, MX : 1.0 Bcfd, (Sempra & Shell)
29. Baja California - Offshore : 1.4 Bcfd, (Chevron Texaco)
30. California - Offshore : 0.5 Bcfd, (Chevron Texaco)
31. St. John, NB : 0.5 Bcfd, (Canaport – Irving Oil)
32. Point Tupper, NS 1.0 Bcf/d (Bear Head LNG - Access Northeast Energy)
33. Searsport, ME : n/a
34. St. Lawrence, QC : n/a (TCPL and/or Gaz Met)
35. Lázaro Cárdenas, MX : 0.5 Bcfd (Tractebel/Repsol)
36. Gulf of Mexico : 1.0 Bcfd (ExxonMobil)
37. Mobile Bay, AL: 1.0 Bcfd (Cheniere LNG Partners)
38. Cherry Point, WA: 0.5 Bcfd (Cherry Point Energy LLC)
39. Cove Point, MD : 0.8 Bcfd (Dominion)
40. Port Arthur, TX: 1.5 Bcfd (Sempra)
41. Puerto Libertad, MX: 1.3 Bcfd (Sonora Pacific LNG)
**US pipeline approved; LNG terminal pending in Bahamas*

Source: FERC Deutsche Bank

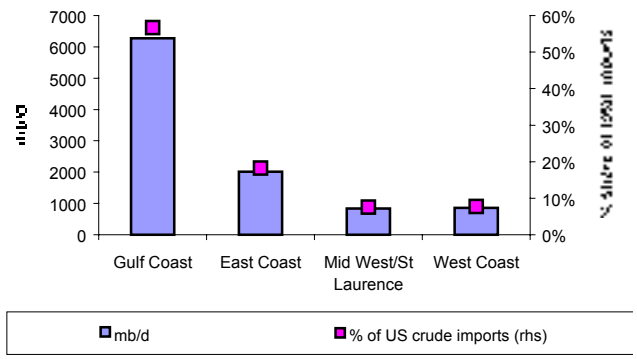
Ultimately there should be relatively few sites – the 16mmb/d US oil market is served by around 10 major import ports, with more than 50% of imports coming through the Gulf Coast. Given that LNG does not even come close to representing the scale of the oil import challenge, 32 terminal projects for LNG is ludicrous. If the entire current US gas market was imported, it would represent 8mmb/d of oil equivalent – manageable with around 12 ports. Our numbers are conservative – we have not included oil products in our comparison, which account for a further 3mmb/d of imports, through the same channels.

Figure 31: Top 10 US crude oil import ports



Source: EIA

Figure 32: Crude imports by coast



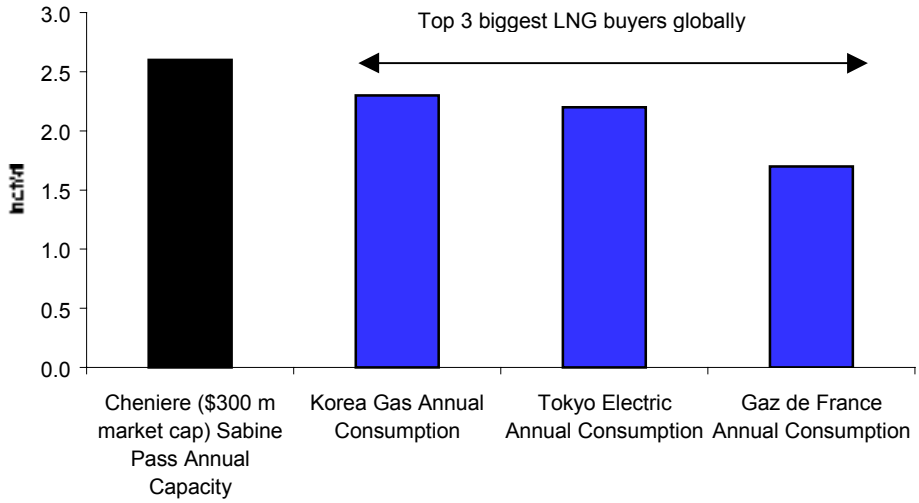
Source: EIA

With the four existing LNG sites, and allowing for the at least two sites likely to progress in Mexico, but not allowing for any additions in Canada, there may only be a need for three or four more sites of the scale of current projects. Most US regasfication projects are large to begin with, typically 1.5bcf/d, and talk about expansions to 2.5bcf/d, e.g. ChevronTexaco's Port Pelican; Cheniere's Sabine Pass. The largest oil import port in the US handles the equivalent of 6bcf/d of gas equivalent. Cheniere, planning for 2.6bcf/d, is thinking big.

That means that no more major regas terminals need to be permissioned – beyond those already approved by the FERC. (Canadian projects follow local government permitting and have stronger local support. However, they are distant and require additional pipeline infrastructure to reach US markets.) Certain niche opportunities, however difficult in terms of local opposition and permitting difficulty, such as in the North East US, are likely to be pursued, regardless. That is because the economic opportunity is so overwhelmingly strong. North East markets enjoy an even greater premium price than wider US gas markets, and as such provide enormous potential returns for those who can go through the pain of the NIMBY. Many are currently undertaking that process. Some will surely succeed.

Establishing which terminals progress is a function of which terminals can get supply of LNG. This is where a market leader such as Cheniere may struggle – beyond its tremendous success in signing a full capacity and capex commitment with ConocoPhillips (1bcf/d + all capex undertaken by ConocoPhillips) and Dow Chemical (500mmcfd offtake) for its recently approved Freeport project. Cheniere is now progressing two plants of tremendous scale in LNG terms – at 2.6bcf/d, each one represents a bigger buyer than any existing LNG buyer in the market, such as Korea Gas (2.3bcf/d), Tokyo Electric (2.2bcf/d) or Gaz de France (1.7bcf/d), the three biggest global LNG buyers). Again, this speaks to our key point: regasification is not the issue, supply is.

Figure 33: A new mega-volume player? Cheniere needs one...



Source: Deutsche Bank Volumes shown are LNG purchses. Cheniere is currently progessing THREE major projects for US LNG regasification

Scale is huge because the costs are high, either for projects being developed in the swamps of Louisiana, with the associated construction costs, or offshore Gulf, with the associated higher capital and operating costs. A typical LNG regasification plant in Europe might be a 300mmcfd project with a $250 m cost. Port Pelican is $600m at least, as a major offshore project with attendant construction costs, and therefore must target huge volumes to make unit costs reasonable. Equally, where construction is not hampered by NIMBY-ism, which to date is primarily in Louisiana, the topography is swamp – hence the lack of back yards. Again, construction costs are very high and as a result, major quantities will need to be imported.

To repeat, there is no issue with regasfication capacity in the US market.

Myths: LNG is unsafe and unpopular; the FERC is suspending approvals because of safety issues and LNG ships are ideal for terrorists

Fact: LNG is relatively safe and is supported by locals in sufficient areas of the US to meet the need for additional regas and the FERC recently posted a safety briefing on its website[3] that concluded that it might conceivably be possible to cause an LNG explosion, though extremely difficult.

Subsequently the erroneous story circulated that the FERC would not permit any more regas terminals until more work was done on safety. This is not true and the FERC has subsequently approved Freeport LNG in Texas.

Figure 34: There's a propane canister in every back yard...and they are relatively dangerous

LNG - Liquefied Natural Gas	LPG (Liquid Petroleum Gas i.e. Propane/Gas Canister)
Frozen, liquefied gas - ie not explosive. Unpressurized - ie container not under pressure, ie not explosive	Pressurised gas ie explosive
Lighter than air - ie does not hang in clouds but dissipates quickly. Requires gasification and then containment (ie indoors) as natural gas to present a risk of explosion.	Heavier than air - ie hangs in clouds, does not dissipate naturally. Will explode outdoors.
High degree of safety required under global standards set by Japanese	Fragmented safety standards in industry dominated by emerging markets
Highly maintained fleet of ships	Fragmented, less controlled fleet of older, less maintained ships
Never present in back gardens. Never exposed to naked flames (would extinguish naked flame)	Present in almost every US back yard. Frequently adjacent to exposed to naked flames - ie adjacent to a barbeque

Source: Deutsche Bank estimates

One of the most bizarre objections to LNG has been the possibility that terrorists may use the ships as "Trojan horses" to enter the US. Unfortunately, in a world of pre-9/11 security, it does seem that Al-Qaeda operatives may have used Algerian LNG tankers as a means of entry to the US. However, most of them entered by more conventional means and if anything, LNG tankers are less attractive modes of transport to terrorists because of their high profile and high safety requirements (Coast Guard escort into Boston with a closed harbour. Boston anyway no longer takes Algerian deliveries.) Again, the more fragmented global oil trade would seem to provide a more worrisome potential target. There has to be a recognition that the US cannot depend on imported oil and gas for more than 50% of its needs, and have no ships landing from the Middle East. Security has to be as tight as possible, but no more so for LNG than for any other import ship.

[3] *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers, www.ferc.gov*

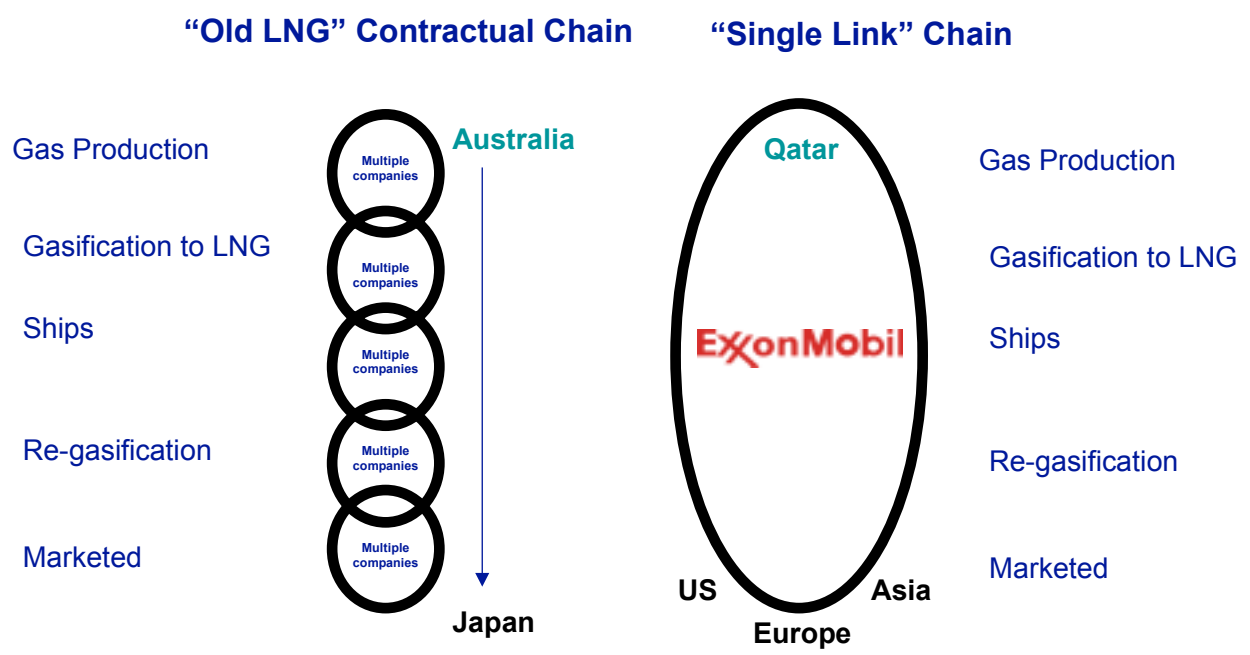
Myths: there is a "new LNG" model that has destroyed the LNG "chain", buyers have the power…and there is a spot market developing in LNG

Fact: the "LNG chain" is now stronger than ever. The cutting edge model is the "single link" chain model. This is a threat to buyers. It also effectively prevents a spot market.

The leading edge of volume growth is now ExxonMobil in Qatar and Shell in Sakhalin II, Russia. These companies are now building the upstream, pipeline, gasification, LNG ships, LNG receiving terminals and marketing the gas themselves. By contrast, the "old LNG" model on the North West shelf was partnership produced gas sold to partnership ships and marketed by Japanese partnerships to multiple buyers. In the ExxonMobil Qatar model, the company is seller and buyer of the gas. BG is using a similar tactic, highlighting not only its position as a major future producer of LNG, but also as a major future buyer.

It is worth noting that a chain, by its nature, is flexible. As such, "single link" players can move LNG to wherever prices are most attractive, potentially leaving uncontracted buyers short of gas, i.e. the US market currently. Under "single link" LNG, buyers must move to secure their own supply. Japanese utilities are increasingly entering the "single link" model themselves, by moving upstream into the model. At ConocoPhillips' Bayu Undan, Tokyo Electric and Tokyo Gas have participated in the "single link" model to supply themselves with gas. This is not a spot market – it is the opposite.

Figure 35: The "LNG chain" is strengthening as scale increases



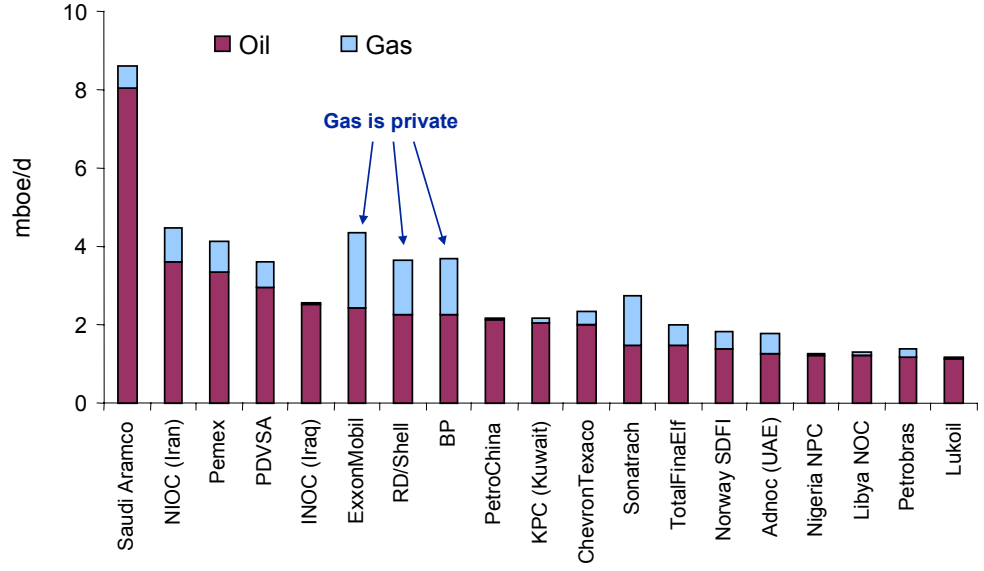
Source: Deutsche Bank estimates

One of the key reasons that the chain is strengthening in LNG is that the scale of individual projects is increasing, making the need for certainty in terms of commitments absolutely vital. Seven million tonne trains and $1bn regas proejcts cannot be built on a speculative basis. The relatively small scale of energy delivered in LNG compared to the capital commitment means that a spot market will only develop amongst those who get their developments wrong. Those who hope to buy LNG on a spot basis from ExxonMobil are certainly getting it wrong.

Myth: the next development is Gas OPEC

Fact: no governments could cartelise an early-phase market in development without killing it. Global gas is developing as a private opportunity. The real question is whether we are on the cusp of the development of a gas Standard Oil – as global gas transport monopolies are currently under development. Nodes of production and means of transport to controlled points of distribution are all absolutely necessary to allow for the development of global LNG in this first phase. As we have already stated, in viewing LNG as the oil of the 21st Century, it must be recognised that we are still at the beginning of the century. The chained model described above, where, for example, ExxonMobil dominates the lowest cost supply from Qatar and has the lowest cost delivery of that gas anywhere globally, will allow companies to dominate their own LNG supply routes to their own advantage. This is absolutely necessary because of the scale of the capital requirement. The consumer will benefit from lower priced cleaner energy than is currently available. Companies are moving to supply a major global need for clean fuel, and are can only do that by contractually protecting their financial commitment.

Figure 36: Global oil and gas production by company



Source: PIW and Deutsche Bank

The latest move by the FERC, in attempting to encourage more US regasficiation development, has been to remove the need for new US regas terminals to offer open access. This is a classic example of local government encouraging early phase market development, by making it extremely attractive to developers, by facilitating the protection of their return on investment.

Of course, that may ultimately lead to a major low cost producer, such as Venezuela or Qatar, delivering into one huge monopoly terminal to the exclusion of other suppliers. A supplier could then theoretically make a monopoly profit while driving out alternative supplies. According to the major potential suppliers from Qatar, such as ExxonMobil and ConocoPhillips, this model should be in place by 2010 – at which point the FERC will need to exercise extremely close scrutiny on gas market behaviour. Equally, in the much longer term, excess profits from LNG may come under scrutiny from needy host governments – this would be Gas OPEC. According to the schedule of the oil market, that should occur from around the beginning of 2060.

Myth: the LNG industry has made a breakthrough on costs

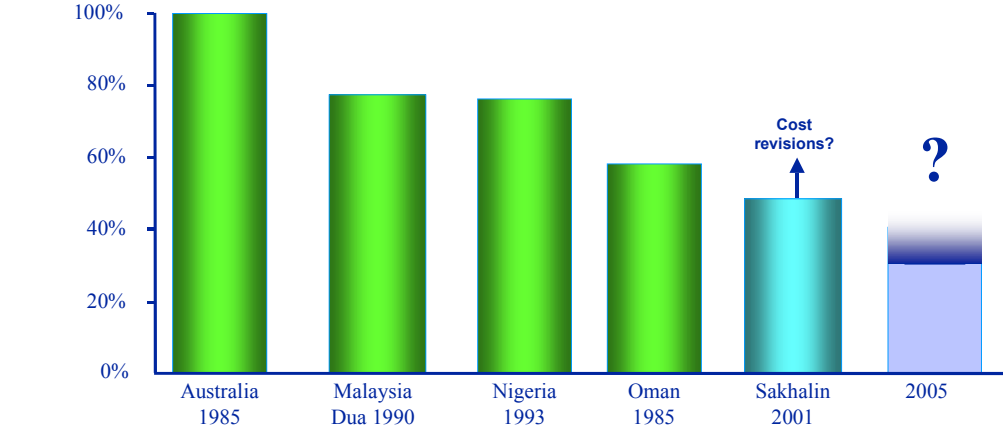
Fact: the industry has just stopped wasting money. The original "new LNG" model, which we identified in 1999, was a means of highlighting how the Trinidad LNG project was different from previous LNG projects built under the Japanese utility model. The primary 'difference' regarding "new LNG" was lower costs. Through several initiatives, the Trinidad plant had lower capital costs than had become the LNG norm. There was no technological breakthrough, there was no major innovation other than in driving down costs to the very minimum, mostly simply by applying standard operating procedures in the oil business to the arcane world of Japanese-utility-dominated Asian LNG. With Japanese utilities selling gas at $24 per mmbtu, and primarily concerned with security of supply, cost was low on the list of priorities. The North West Shelf gas project was a high watermark in terms of excess cost and poor returns for LNG. Shell now uses it to benchmark its improved cost performance.

1. At Trinidad, netback pricing was introduced whereby the price received by the gas producers was set by back-calculating from the price at which the gas was sold. While totally standard practice in the oil market, this was a LNG innovation. The risk of netback pricing (because of fluctuating US gas prices) meant that costs became a priority. Previously they had not been.

2. Competitive tendering was introduced at Trinidad for the technological process and for the first time since the late 1960s. The "Phillips Cascade" method was chosen as the LNG process, and by re-introducing competition amongst technologies, costs at Trinidad took a step down. Competitive tendering was hardly a stunning innovation...what was stunning was that it wasn't being used until the late 1990s in the LNG business.

3. Where Trinidad got it wrong was scale. Cautiously put together, the project did not have a very large site and was developed as a niche plant. The developers did not realise how high the US gas price would go. In fact, the higher US gas price, and global gas price, is a bigger factor in the competitiveness of LNG than any reduction in costs. US gas prices have risen 200% from long-term historical averages in 2004, LNG costs have been driven down, but primarily future cost savings will be due to scale. At best, we estimate unit costs may have another 20% to fall.

Figure 37: The industry now wastes less money



Source: Shell

Chart shows EPC cost, normalised on location relative to NWS project

Source: Shell., Wood Mackenzie

Myth: there is excess LNG supply

Fact: the LNG market is tight and there is no major supply overhang developing, far from it. Historically, the LNG trade was based on security of supply, with Japanese utilities leading the development of the industry as a reaction to oil price shocks. As a result, the industry was built with a considerable amount of spare capacity, with the Japanese running contracts to buy gas over a 20 or 25-year period with around 10% flexibility on annual volume offtake. Broadly speaking, as a result, the LNG business developed with around 10% spare capacity at mid-cycle.

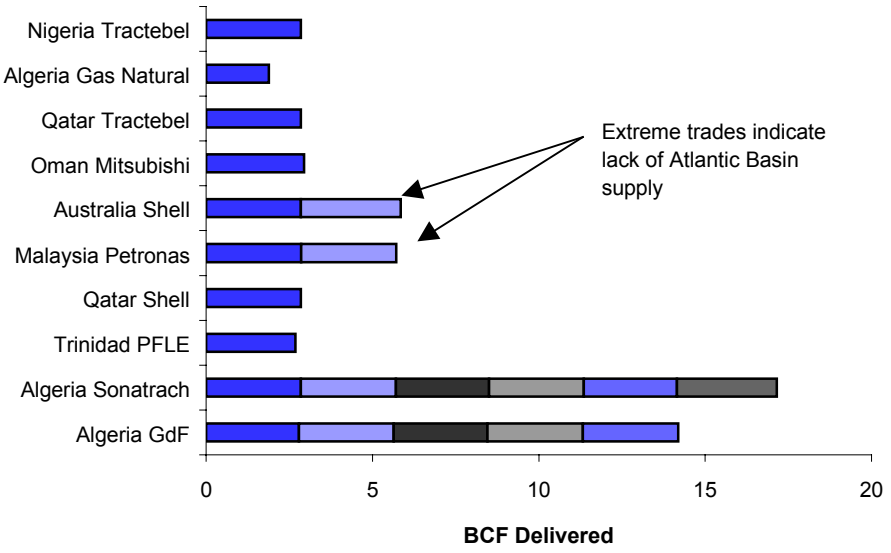
Three major factors have tightened global LNG supply over the past five years.

1. Having found itself with huge excess quantities of LNG in the Asian economic crisis of 1998, South Korea began to run down its excess contracted LNG volumes. South Korea optimised its position in the supply and demand balance by offtaking spare Japanese cargoes on a spot basis. However, the major nuclear scandal at Tokyo Electric shut down 17 nuclear reactors and resulted in a tightness of LNG supply into the cold winter of 2002/03, which left the Koreans scrabbling for LNG volume. As a result of the energy shortage the country found itself in, the Koreans and Japanese have moved to commit to more volumes, and there has been relatively little spare LNG available.

2. More extreme weather in Europe, particularly the super-hot summer of 2003, and normal winters have sucked in LNG to supply strong demand for gas.

3. On the supply side, a surprising number of plant outages. These started with a pipeline issue at Bontang in 2002, continued with an explosion and outage at the brand new Malalysia Tiga project in 2003, then saw a major explosion at the Algerian Skikda plant in 2004, and outages in Qatar and most recently in Trinidad. All these elements have conspired to tighten the global LNG balance just as oil has become an expensive alternative fuel. At the same time in 2004, there is no new project start up, but the first demand from India and US terminals such as Cove Point. That is, demand is outstripping supply.

Figure 38: January to June 2004 LNG deliveries to Lake Charles



Source: Waterbourne LNG report

There are around four LNG ships currently idled – indicating, when combined with spare capacity at US regasification facilities, that there is a lack of available supply. Equally, an analysis of the provenance of LNG currently being delivered into the US markets shows some extremely distant trades, and to that extent implies that Atlantic Basin LNG supply is short.

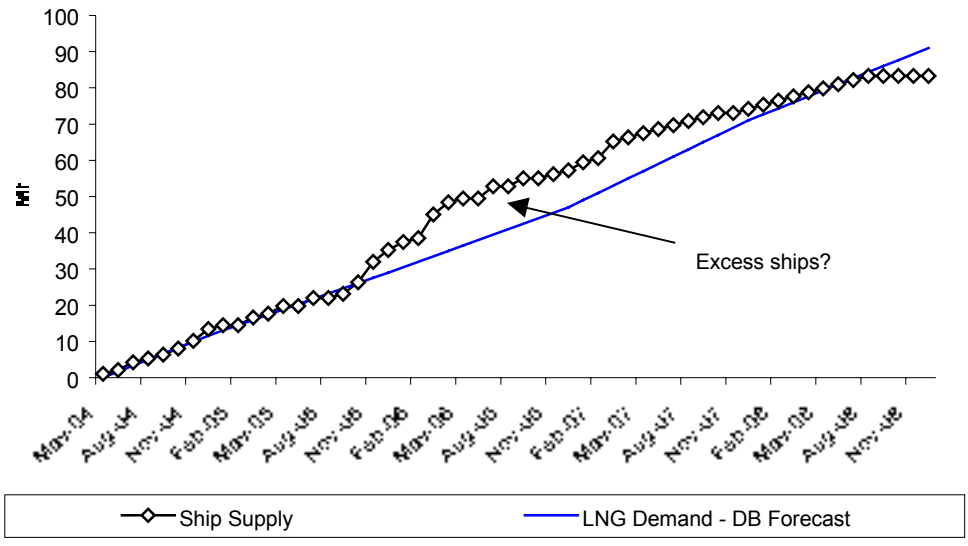
Myth: there are insufficient ships to meet future demand for LNG

Fact: there is currently a surplus of ships and arguably there is a bigger surplus developing in the near future (see Figure 39). The "speculative build" has been much faster to develop in the world of shipping – with its higher risk capital – than in the world of LNG supply.

It has to be said that precise matching of the ship capacity vs. demand line is not possible as ships can deliver more or less LNG depending on the length of their voyage. An alternate explanation of Figure 39 would be that the LNG industry is entering a phase of longer ship voyages, which fits with the development of such trades as Egypt-USA and Qatar-USA, rather than the more logical, economic and profitable Trinidad-USA or Venezuela-USA.

As an aside, the failure of Venezuela to develop LNG for the delivery into the US market is one of the great missed opportunities of recent times. Venezuela's LNG industry has been on the drawing board since the early 1970s – and it was potentially profitable then! It is rightly to the embarrassment of Venezuelan petroleum executives that smaller Trinidad, with less gas reserves and a less established oil industry, has succeeded in developing the largest Atlantic Basin LNG plant over the past seven years. Having said that, Trinidad itself was many years at the development stage before commitment was made to the plant development.

Figure 39: LNG ship supply and Deutsche Bank's global LNG demand forecast



Source: Clarksons, Deutsche Bank estimates

Myth: LNG will crash (or cap) the US gas price

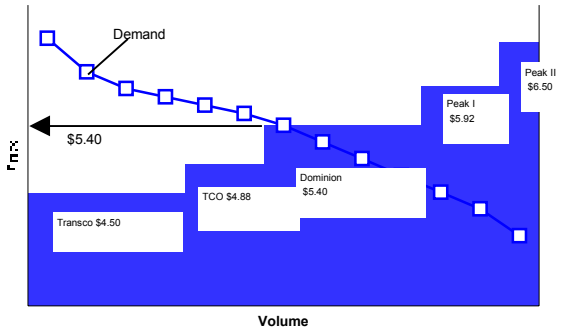
Fact: insufficient supply potential into the US markets makes LNG a marginal, regionalised fuel until beyond 2010. Shorter term, the price impact of LNG onto the highly regionalised US gas market is impossible to predict. A marginal cost of supply curve is extremely difficult to create accurately into a declining gas market that is rapidly shifting in terms of cost of supply and price of demand.

1. Existing incumbents are leaving their production behind (i.e. ExxonMobil, ChevronTexaco selling out of US onshore). However, aggressive newer players (XTO, Encana) are entering to re-vitalise many mature areas. Whilst production per well and other measures are clearly falling, the new era of aggressive investment in US domestic gas – at a higher gas price assumption – is only beginning.

2. Furthermore, the impact of new infrastructure on marginal price curves is large and unpredictable. There is an argument that says that Enron and its impact on the US gas transmission business has prevented the development of sufficient US pipeline infrastructure to meet supply and demand efficiently, hence today's extreme price environment. Major price disconnections are possible, but are unlikely to last long. BG is quite open that it was surprised at the price impact individual cargoes of LNG had on Lake Charles' local pricing, but that they would add infrastructure to alleviate the problem of a single offtake pipeline.

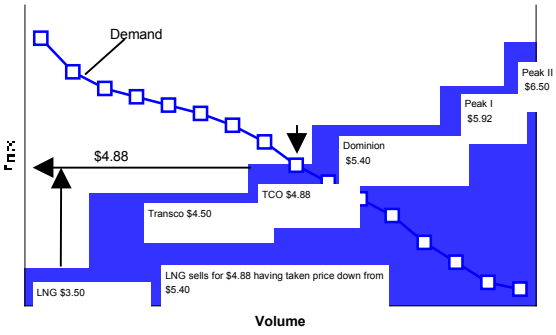
3. Regionally speaking, LNG is likely to have a fairly dramatic impact on prices, at times disproportionate to the additional volumes being delivered, because it will shift the marginal supply curve, potentially away from a relatively small volume of gas production at a relatively high price (see Figures 38 and 39). Equally, the net effect may simply be to free up relatively high priced gas that may not find a market elsewhere.

Figure 40: Before LNG, gas prices to marginal supply



Source: Energy Bar Association

Figure 41: After LNG, a potentially significant shift as it enters at the lowest part of the supply curve



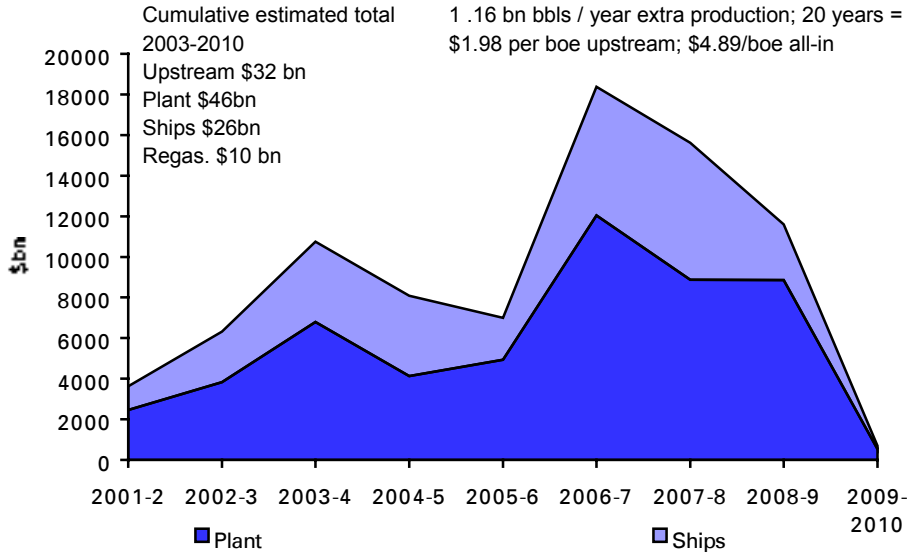
Source: Energy Bar Association

Who wins?

With gas prices high and volumes tight, who can deliver?

With LNG deliverable globally at $3 per mmbtu, the higher US gas price represents a huge opportunity that we think companies will rush to fill. We reiterate our long-standing forecast of major increases in LNG capital spending over the coming years (and decades). Companies with exposure to this are Buy-rated stocks: Halliburton; Technip; Chiyoda, and Air Products. Additional plays on the theme are Snam (SRG.MI, EUR 3.5, Hold), Chicago Bridge and Iron (CBI, not rated), and Daewoo Shipbuilding (Not Rated).

Figure 42: Estimated capex in global LNG 2001-2010E



Source: Deutsche Bank estimates

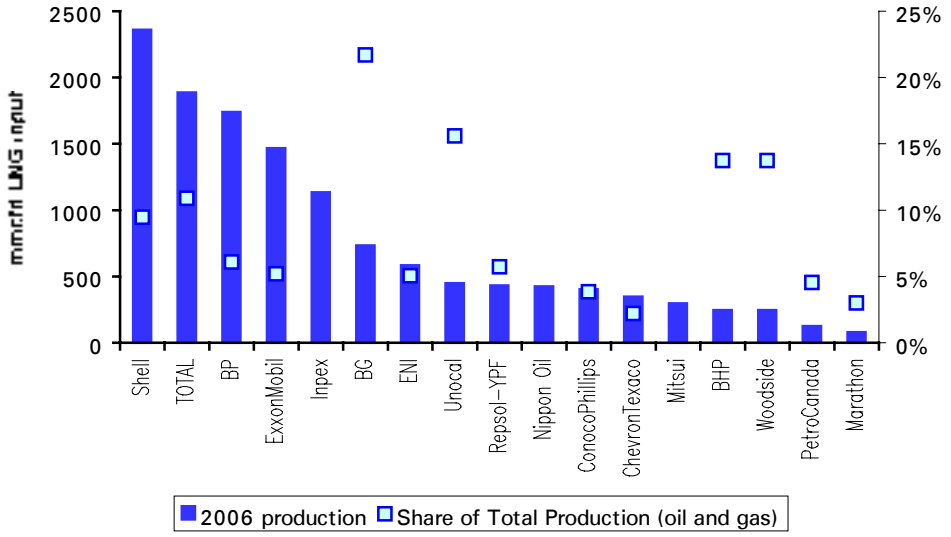
Euphoria over some of the lower return elements of the business may be over-stated. We deny the emergence of a major traded spot market in LNG and consider the "LNG chain" to be strengthening and tightening in future, as projects become bigger, more capital intensive, and therefore more bound by contractual links. If the speculative, or spot, market was really here, surely one of the permissioned US LNG regasification greenfield projects would have started construction – they have not.

Certain LNG-exposed companies will make no more money from higher gas prices, and will be threatened by rapid growth, as they are essentially utility businesses. These are LNG shippers (Golar LNG, not rated; Teekay shipping, not rated) and LNG regasification plays (Cheniere LNG.A, not rated). However, these companies may be attractive take-out candidates within the theme of more tightly integrated contractual chains, e.g. if ExxonMobil needs a quick fix to its lack of US regasification capacity and if organic development proves too time consuming and frustrating.

Amongst conventional gas producers, where the highest returns and highest leverage to higher gas prices are to be found, the relative growth is with the traditionally dominant plays. These are Shell, BP, BG, TOTAL, ExxonMobil, Eni,

ConocoPhillips – companies that have invested heavily over the past five years and should now reap the rewards.

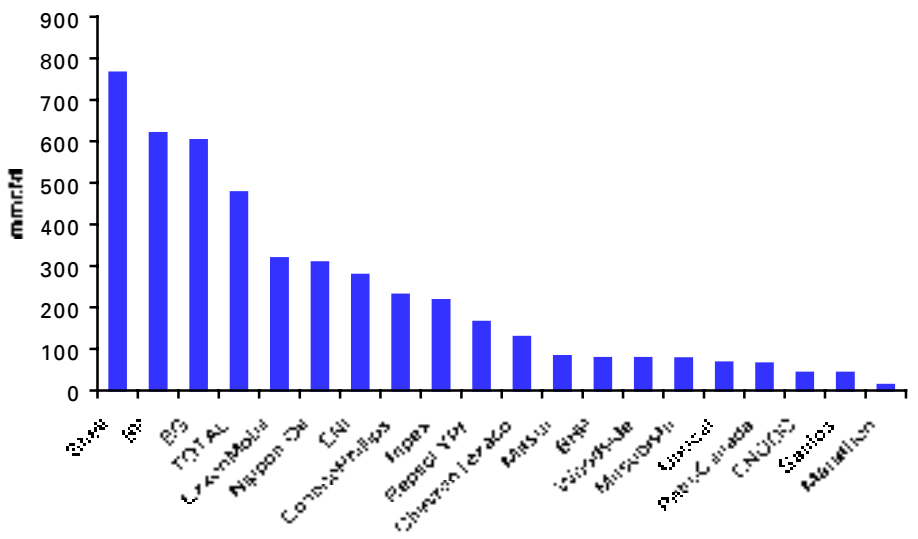
Figure 43: Gas into LNG production 2006E



Source: Deutsche Bank

Key growth names in LNG are the same names that dominate the industry in terms of overall value. The exception is the rise of ConocoPhillips and the lack of growth from Unocal. Our analysis shows that Repsol and ChevronTexaco also show growth in the 2007E timeframe.

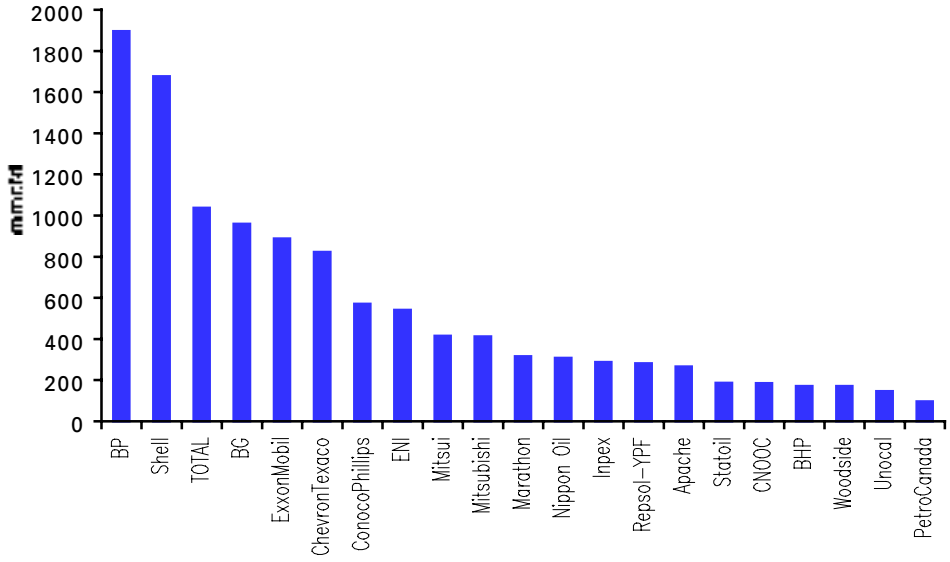
Figure 44: Growth in gas into LNG 2003-07E



Source: Deutsche Bank

Longer-term growth stories present some interesting additional companies. There is clearly a higher degree of uncertainty surrounding project deliveries in these numbers, but they provide our best-informed view of longer-term growth. BP is a winner through additional gas into Egypt's SEGAS project, which is by no means a certainty. Equally, BP will need to convert Trinidad 5 into a producing project before 2010 (not to mention Tangguh), for these numbers to be proved representative.

Figure 45: Growth 2003-2010E in gas into LNG production



Source: Deutsche Bank

Certain companies simply do not appear in the top 20 names in LNG. Occidental has no position before 2010, while Amerada Hess has such a small stake in Snoevhit that it does not register on the leader board. Marathon is very clearly the mid-cap US play on LNG. The US large caps accelerate their performance, but remain well behind their European counterparts in terms of LNG.

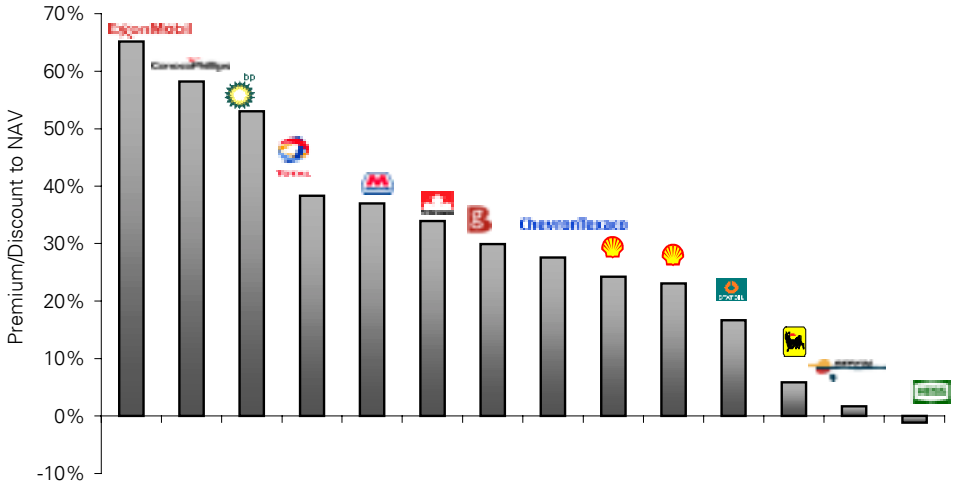
If the US gas market develops as expected over the period 2010-2020, then it may well be the US names, not least the US independents such as Apache from Egypt, EOG and PetroCanada from Trinidad, and possibly Oxy, Hess and ConocoPhillips from Libya, that will rise through the top names. However, these companies themselves would admit that they are playing catch up to such first movers as BG and the super-cap Europeans.

Risks: project development and management

Mismanagement could lead to enormous value destruction

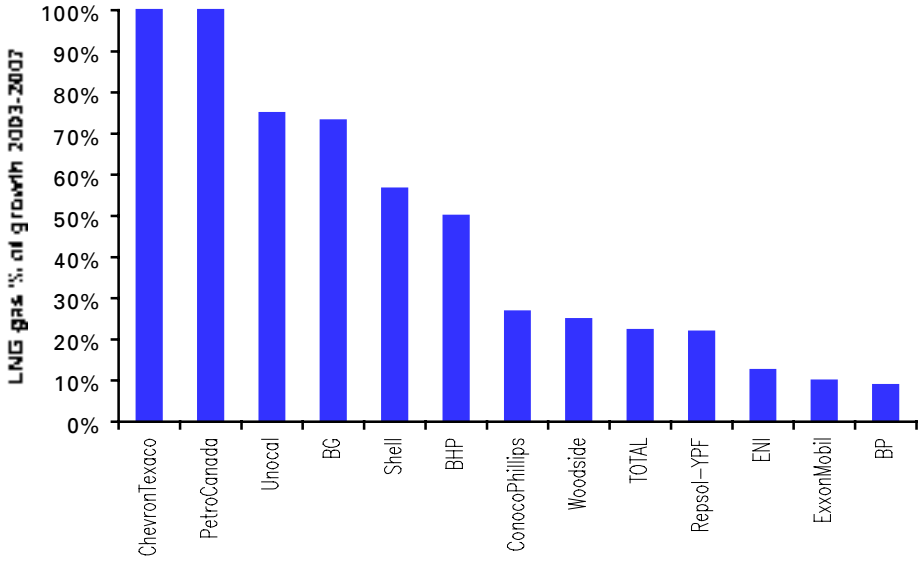
Companies need to invest billions and must successfully manage the process, otherwise value destruction will be enormous. Projects are in risky places, either technically – such as the extreme Northerly Barents Sea for Statoil's Snoevhit, politically – such as Angola, the Middle East (Qatar), or from a labour dispute point of view – such as Trinidad. Companies that mismanage projects in development and operation are likely to cost shareholders literally billions. Investors must be convinced that they are entrusting their money to top quality managements, or be rewarded with an appropriately risked entry price. Unable, as we are, to judge managements objectively (at least in print), we point to NAV premium discount as the market's valuation of management quality.

Figure 46: NAV premium/discount – market's view of management quality



Source: Deutsche Bank, companies shown only integrated majors with LNG project exposure

Figure 47: Who needs LNG? Relative exposure to growth from LNG

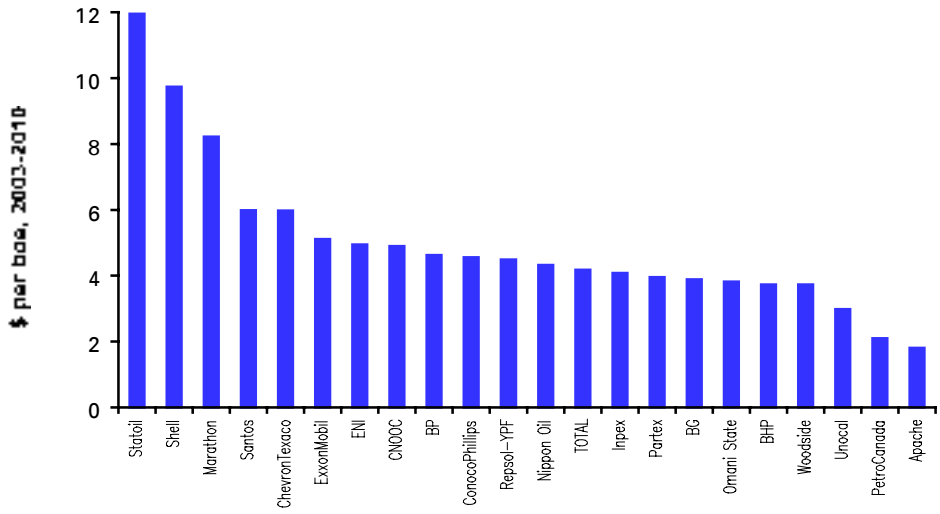


Source: Deutsche Bank

Who *needs* the LNG? As above, companies reliant on LNG growth and have few alternative volume growth drivers are most leveraged to LNG – ChevronTexaco and PetroCanada reveal themselves to be dependent on LNG for providing any kind of growth.

An alternative risk calculation is capex per boe of production. Of course, this is problematic because pure boe production numbers do not capture returns on capital expenditure, nor investment this decade for growth next. Nevertheless, a first glance of approximate capex dollars per boe of additional production 2003-2010 throws up some interesting exposure to relatively high levels of capex for relatively little production over the next 10 years, particularly for Statoil and Shell. However, we stress that current pressure on book returns is likely to lead to longer-term high free cashflow as LNG drives gas delivery in the 21st Century. In other words, high capex for the next decade is not *necessarily* a bad thing, assuming projects are on time, on budget, and perform with long lives. However, history says the market will pay for growth now, not capex now.

Figure 48: LNG capex per boe of LNG gas production 2003-2010



Source: Deutsche Bank

Appendix 1

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Additional information available upon request

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Paul Sankey

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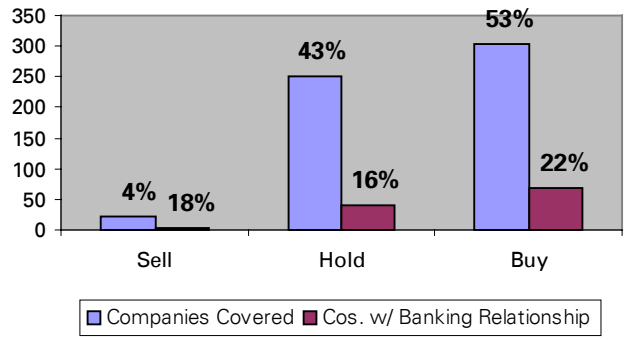

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