

Simmons Oil Monthly Qatar

Despite being one of the smallest countries in the Middle East in terms of land mass and population, Qatar is home to what is believed to be the largest non-associated natural gas field in the world (the North field). The country's aggressive development strategy has positioned Qatar as a leading source of supply for global natural gas and particularly LNG. Existing and emerging LNG markets have come to rely on volumes from Qatar. The country's 77 mmtpa (10.3 bcfed) of planned liquefaction capacity is already fully committed for a period of 25 years with additional would be buyers waiting for an allotment of supply. Meanwhile, in the midst of an LNG market that is already short of supply, the Qatari's placed a moratorium on new projects. Qatar's natural gas strategy, proved resource base and production capability have important implications for the global natural gas market.



Source: worldoil.com

Qatar accounts for a large and growing share of the global natural gas market. Qatar accounts for 14% of global LNG supply today and an estimated 25% by 2015.

A hold has been placed on new projects. Qatar has decided not to approve any additional North field projects pending completion of an updated reservoir study ('07/'08) and potentially longer if their 900 tcf reserve estimate does not increase and concerns of potential overproduction of the field do not abate.

Much has yet to be learned about the North field. The North field is a carbonate reservoir lying approximately 11,000 feet below the Arabian Gulf in water depths ranging from 50 to 230 feet. Industry representatives we have spoken with about the field stress its complexity, non-homogeneity and lack of full delineation, leaving a large degree of uncertainty about the true potential of the field.

The world remains short of LNG supply. Several companies and countries are looking for additional LNG supply commitments, but new project announcements are proving few and far between.

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Important disclosures appear in Appendix D

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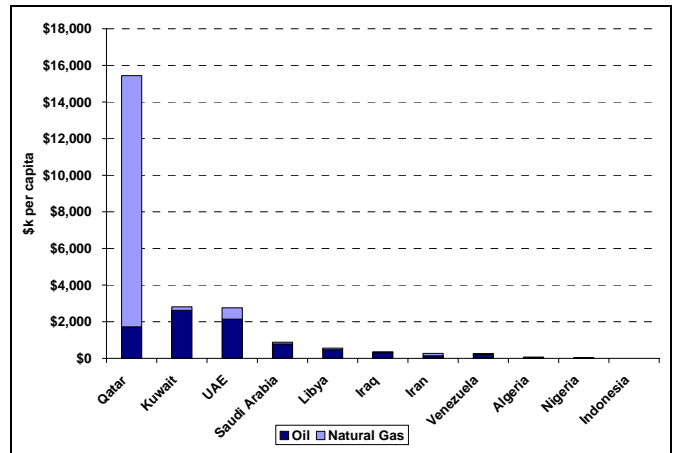
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Background. Qatar gained independence on September 3, 1971, having been a British protectorate from 1916 up until that point. Upon initial separation from Britain, Qatar had joined forces with Bahrain and seven other states only to break away from the group that would later become the United Arab Emirates (UAE). Emir Hamad bin Khalifa Al-Thani has ruled Qatar since 1995, after seizing control from his father while on vacation in Switzerland. Qatar's first oil production came from the large onshore Dukhan field in 1949. Dukhan remains Qatar's largest producing oilfield and still accounts for almost 40% of Qatar's oil production capacity. However, production has since commenced on several offshore fields. Qatar's main oil and gas asset is the North field (believed to contain 900 tcf, 150 billion boe of natural gas reserves). The field was discovered in 1971, but without a near-term market, no decision was made to develop the field until the late 1980's. Qatar has plans for 25 bcfd of production capacity from the North field by early next decade.

A small population with a large estimated hydrocarbon resource base. Qatar has a relatively small proved oil resource base, at least by OPEC standards, with 15.2 billion boe of stated proved oil reserves (ranking 9th within OPEC-10, ahead of Indonesia). However, inclusive of its 152 billion boe of natural gas reserves, Qatar ranks 3rd behind Saudi Arabia and Iran for total estimated hydrocarbon reserves. Meanwhile, Qatar's population is only 2.7% that of Saudi Arabia and 0.9% that of Iran. The result is a significant per capita estimated resource base. Qatar's per person proven oil and gas reserves are 269k boe, 6.5x that of the UAE (the next closest OPEC member), 21x that of Saudi Arabia and 62x that of Iran. Using current oil prices of ~\$70/boe and assuming a 20% BTU discount for natural gas realizations, Qatar's undiscounted future oil & gas revenue is roughly \$15mm per person (or \$154k per year when amortized over the 100 year R-P target), 17.5x that of Saudi Arabia and 57x that of Iran. While still classified as a welfare state with an undiversified economy, Qatar at the moment has a significantly larger buffer to support future spending on social programs than its larger neighboring countries.

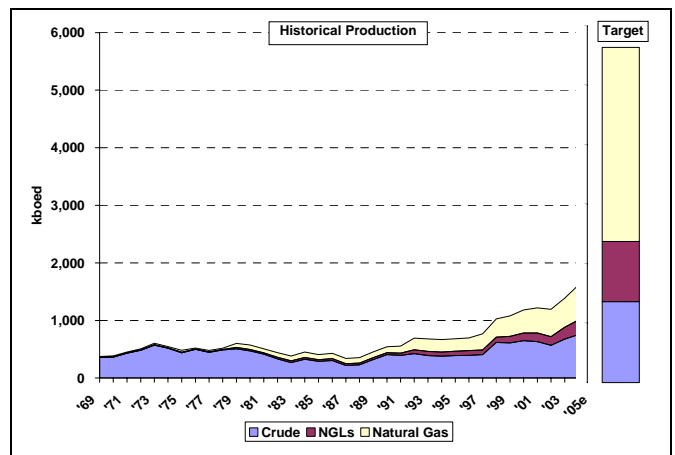
Figure 1: Undiscounted Future O&G Revenue per Capita



Source: Simmons & Company International
 Note: Assumes 6:1 natural gas conversion, \$70/b crude prices and 20% natural gas price discount.

Oil and natural gas production is expected to increase exponentially within five years. Qatar's current oil and gas output of approximately 1.7 mmboed is targeted to increase approximately 230% to almost 6 mmboed by 2011. An 85% increase is expected from the North field alone. As a result, Qatar's mix of natural gas and associated liquids as a percent of total hydrocarbon production is anticipated to rise from 55% at present to 76% by 2011.

Figure 2: Historical and Targeted Oil & Gas Production



Source: OPEC, IEA

Oil production. Qatar has been producing crude oil since 1949 from the large onshore Dukhan field. Offshore production comes from 11 fields, including liquids associated with natural gas produced from the North field.

Figure 3: Major Qatari Oil Fields

Field	Startup	API Gravity	Capacity kbd
Dukhan	1949	41	400
ISND	1964		100
Maydan Mahzam	1965		60
Bul Hanine	1973		100
Al-Shaheen	1994	29-33	200
Al-Rayyan	1996		70
Al-Khalij	1997	28	80
ISSD	1999		17
Al-Karkara / A-North	2005		10
			1,037

Source: Simmons & Company International

Primary oil fields. Notes on each of Qatar’s main oilfields is included below. Most of the information is sourced from the U.S. EIA, supplemented by industry discussion and press reports.

○ **Bul Hanine**

- Online in 1973.
- Early production exceeded 100 kbd.
- Production began falling in early 1990s.
- Current production capacity is ~100 kbd.
- Development plan in place to drill 86 wells
- 700 mmb of estimated reserves.

○ **Maydan Mahzam**

- First operational in 1965
- Current capacity is ~60 kbd
- Output has declined significantly from peak
- Production was at 70 kbd in late-’04.
- QP is undertaking renovation on the field

○ **Id al-Shargi North Dome (ISND)**

- Discovered by Shell in 1961.
- Now operated by OXY.
- 59 miles east of Qatar’s northern tip
- Produced 20 kbd in ’94 when OXY signed 25-year PSA, agreeing to invest \$700mm.
- Current output is ~100 kbd.

○ **Id al-Shargi South Dome (ISSD)**

- OXY signed a PSA in September, 1997.
- Located 15 miles from ISND.
- Designed to operate as satellite to ISND.
- On stream November, 1999 at 11 kbd

- Recent output of ~17 kbd.
- Estimated recoverable reserves: 200-300 mmb.

○ **Al-Shaheen**

- Operated by Maersk Oil Qatar of Denmark
- Current production capacity of ~200 kbd.
- Located in block 5
- 43 miles off Qatar’s northeastern coast.
- Heavy, 29-33 degree API, 1.7-2% sulfur.
- Above and potentially linked to the North field.
- Recent initiative to drill 70 additional wells.
- Expected increase to 525 kbd by late 2009.

○ **Al-Rayyan**

- Newer oil field
- Operated by Anadarko – bought stakes from BP, BG, Wintershall and Gulfstream from ’01 to ’02.
- Onstream November, 1996 – 20 kbd of heavy oil from 4 wells.
- Currently 70 kbd.
- Block 12
- PSA signed on July 16, 1997.
- APC acquired exploration acreage in May, 2004 on adjacent Block 4 and plans exploratory drilling over 5-year period.

○ **Al-Khaleej**

- Latest oilfield to come onstream
- Startup: March, 1997, after five years of exploration and appraisal work. Initial rate: 6 kbd.
- Location: Block 6, along border w/ Iran, east of the North Field.
- Development had been delayed since 1991 as Elf Aquitaine Qatar had sought improved PSC terms from QP.
- TOT completed a capacity expansion in mid-’04 that brought total capacity to 80 kbd.
- Medium/sweet 28-degree API gravity, 1% sulfur
- Oil piped to Halul Island for processing and transport.
- TOT holds 100% interest in the 25-year PSA with option for five-year extension (acquired NI’s 45% stake in May, 2002).

Qatar (continued)

Up and coming member of OPEC. Based on OPEC’s official project list and stated capacity figures, Qatar currently ranks last in OPEC for crude oil & NGL production capacity. However, associated production from several North field projects is expected to bring Qatar’s liquids production ahead of both Indonesia and Algeria by 2011. As a side note, figures below are OPEC estimates, not SCI estimates and assume a default 5% decline rate for illustrative purposes.

Figure 4: OPEC Liquids Production Capacity Rank (kbd)

	2006	2007	2008	2009	2010
Algeria	1,505	1,539	1,611	1,653	1,639
Indonesia	1,060	1,023	1,022	1,048	1,157
Iran	4,610	4,787	4,627	4,498	4,531
Libya	1,725	1,735	1,669	1,586	1,506
Kuwait	2,950	2,828	2,712	2,577	2,673
Nigeria	3,155	3,160	3,207	3,317	3,384
Qatar	995	1,053	1,290	1,582	1,729
Saudi Arabia	11,568	11,547	11,762	12,215	12,512
UAE	2,948	2,991	2,857	2,814	2,779
Venezuela	2,750	2,613	2,482	2,358	2,240
TOTAL OPEC	33,265	33,274	33,239	33,648	34,148
Qatar Rank	10	9	9	9	7

Source: Simmons & Company International

Note: Based on OPEC stated capacity, not SCI assumptions.

Note: Includes NGLs.

Note: Assumes base decline rates of 5% p.a.

Significant number of projects in Qatar’s North field.

Between now and 2011, Qatar plans to bring online seven new LNG trains with a cumulative capacity of 51.5 mmtpa (6.9 bcfd), bringing total LNG liquefaction capacity to 77 mmtpa (10.3 bcfd). Natural gas feed into the plant must be higher by approximately 14% in our estimation in order to offset natural gas burned or otherwise lost in the liquefaction process. Production of NGLs associated with liquefaction facilities is expected to amount to 756 kboed. Other projects, including the ExxonMobil-operated Al-Khaleej domestic natural gas project and the Dolphin pipeline to the UAE are expected to add 2.6 bcfd in the near-term and 4.7 bcfd long-term and are expected to produce 335 kboed of associated liquids. Feedstock requirements for the Pearl and ExxonMobil GTL facilities are expected to be 3 bcfd and

upstream components to these integrated developments are expected to yield 265 kboed of associated liquids.

Figure 5: North Field Project Listing

Liquefied Natural Gas (LNG)							
Project	Startup	Train	LNG		Feed mmcf	Liquids mmcf	Total mmcf
			MTPA	mmcf			
QatarGas	1997	1	2.0	267	310	118	428
QatarGas	1997	2	2.0	267	310	118	428
QatarGas	1998	3	2.0	267	310	118	428
QatarGas	2003	D1	1.1	147	171	65	235
QatarGas	2003	D2	1.1	147	171	65	235
QatarGas	2003	D3	1.1	147	171	65	235
QatarGas II	2008	4	7.8	1,040	1,209	460	1,669
QatarGas II	2009	5	7.8	1,040	1,209	460	1,669
QatarGas III	2009	6	7.8	1,040	1,209	460	1,669
QatarGas IV	2011	7	7.8	1,040	1,209	460	1,669
RasGas	1999	1	3.3	440	512	194	706
RasGas	1999	2	3.3	440	512	194	706
RasGas	2004	3	4.8	640	744	283	1,027
RasGas	2005	4	4.8	640	744	283	1,027
RasGas	2007	5	4.7	627	729	277	1,006
RasGas	2008	6	7.8	1,040	1,209	460	1,669
RasGas	2010	7	7.8	1,040	1,209	460	1,669
			77.0	10,267	11,938	4,536	16,474

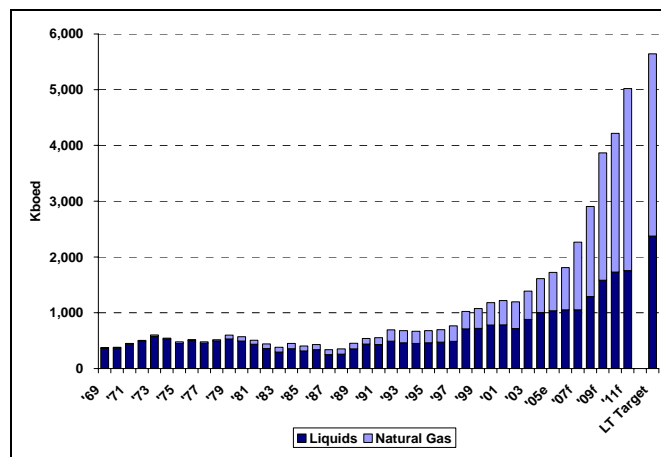
Regional Natural Gas Projects					
Project	Startup	Train	Feed mmcf	Liquids mmcf	Total mmcf
Al Khaleej	2005	Initial	600	300	900
Al Khaleej	Undecided	Future	1,050	570	1,620
Dolphin	2007	Initial	2,000	760	2,760
Dolphin	Undecided	Future	1,000	380	1,380
			4,650	2,010	6,660

Gas-to-Liquids (GTL)				
Project	Startup	Feed mmcf	Liquids mmcf	Total mmcf
Oryx	2006	330*		330*
Pearl	2009	1,600	600	2,200
XOM	2011	1,400	990	2,390
		3,000	1,590	4,590

Total (bcfd)			TOTAL	19,588	8,136	27,724
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Source: Simmons & Company International

Figure 6: Qatar Production Growth Targets



Source: Simmons & Company International

Refining. Qatar has one refinery complex at Umm Said with a current capacity of 137 kbd (expanded from 57.5 kbd in 2002).

Petrochemical. Qatar's existing petrochemical complex (Q-Chem) was first brought online in 2002 as a joint venture owned 51% by QP and 49% by Chevron Phillips Chemical Company (CPCC). The complex includes a 500ktpa Ethylene unit, 453ktpa Polyethylene plant and a 47 ktpa Hexene unit. An expansion project is underway, with completion expected in 2008. Expansion plans include a 1.3 mmtpa ethylene cracker owned by Qatofin (a JV owned 63% by Qatar Petrochemical Company (Qapco), 36% by Total S.A. and 1% by QP) and Q-Chem. In addition, the Q-Chem II project will include a 350ktpa polyethylene unit and 350 ktpa Normal Alpha Olefins plant. Qatofin is constructing a 450 ktpa LLDPE unit, which is also planned for completion in 2008.

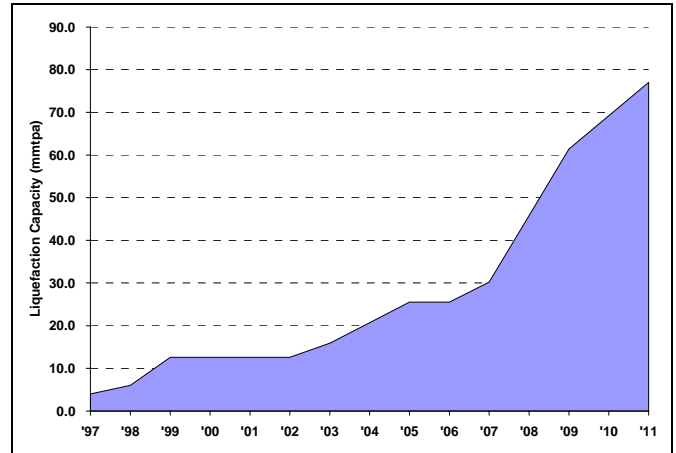
Other industrial activities. According to the U.S. EIA, Qatar has 2,260 megawatts of electric generation capacity. Approximately 70% of Qatar's electricity is used by the residential sector, with free electricity offered to Qatari citizens (expats have been excluded from the free electricity provision since 1999). Other industries include fertilizer (Qatar Fertilizer Company), other chemicals such as ethylene dichloride, vinyl chloride monomer and caustic soda (Qatar Vinyl Company), fuel additives, steel, concrete and aluminum.

The North Field

Single, most important natural gas field in the world. The North field is currently assumed to contain approximately 900 tcf of recoverable natural gas reserves, accounting for 14% of the 6,337 tcf of worldwide natural gas reserves according to the BP statistical review of world energy. In addition, Iran's South Pars field (a geological extension of Qatar's North field) is estimated to contain 280 tcf of reserves. Taken together, the North field and South Pars are assumed to hold 1,180 tcf of reserves, or roughly 19% of the world total. The north field covers an area of over 6,000 sq. km, almost half of the surface area of Qatar. Reservoir depth is up to 11,000 feet. Pressure is up to 5,200 psi (350 Barg). The field is a carbonate reservoir with approximate thickness of 1,500 feet (this varies considerably throughout the reservoir).

A dominant future supplier of LNG. Qatar's present LNG liquefaction capacity of 25.5 mmtpa (3.4 bcf/d) accounts for approximately 14% of the world's total and consists of QatarGas trains 1 through 3 (debottlenecked in 2003) with a total capacity of 9.3 mmtpa (1,240 mmcf/d) and RasGas trains 1 through 4 with a total capacity of 16.2 mmtpa (2,160 mmcf/d). While meaningful today, Qatar will take an even more dominant role going forward. Current liquefaction capacity construction projects in Ras Laffan are expected to bring total capacity to 77 mmtpa (10.3 bcf/d) by 2011. By 2015, Qatar will account for approximately 1/4th of the world's LNG liquefaction capacity. Calculated differently, approximately 1/3rd of the expected growth in global LNG supplies from now through 2015 are expected to come from the North field alone.

Figure 7: Qatar LNG Liquefaction Capacity



Project	Startup	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11
QatarGas	1997	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
QatarGas	1997	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
QatarGas	1998		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
QatarGas	2003							1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
QatarGas	2003							1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
QatarGas	2003							1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
QatarGas II	2008												7.8	7.8	7.8	7.8
QatarGas II	2009												7.8	7.8	7.8	7.8
QatarGas III	2009												7.8	7.8	7.8	7.8
QatarGas IV	2011															7.8
RasGas	1999			3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
RasGas	1999			3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
RasGas	2004								4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
RasGas	2005									4.8	4.8	4.8	4.8	4.8	4.8	4.8
RasGas	2007										4.7	4.7	4.7	4.7	4.7	4.7
RasGas	2008												7.8	7.8	7.8	7.8
RasGas	2010															7.8
		4.0	6.0	12.6	12.6	12.6	12.6	15.9	20.7	25.5	25.5	30.2	45.8	61.4	69.2	77.0

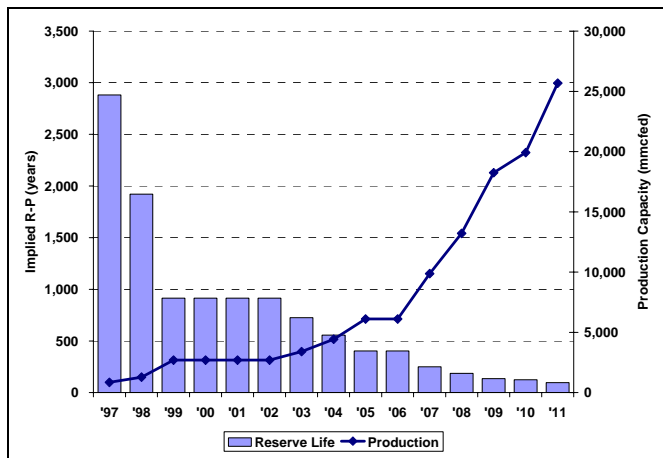
Source: Simmons & Company International

Expectations for 100 years of production. Based on current production capacity, the North field has a stated R-P ratio exceeding 400 years. Meanwhile, the Qatari oil minister, H.E. Abdullah bin Hamad al-Attiyah, has made clear on several occasions his country's intent on developing the North field into a resource that will remain in production for over 100 years. This would not seem to be much of a challenge on current reserve assumptions and production rates. However, the 320% increase in production capacity planned over the next five to six years will bring Qatar's expected production to 25 bcf/d and the North field's reserve life to 97 years (slightly below the minister's target of 100 years). This leaves little room for error if what is believed to be the world's largest gas field turns out to be anything under 900 tcf. Accordingly, Qatar has chosen to first learn more about the field through an active drilling and seismic campaign. The minister informed us that 17 rigs are running in the North field, with "hundreds" of wells already drilled. In the near-term, Qatar is undertaking an initiative to update the North field reservoir models. They anticipate completion of their near-term reservoir re-evaluation in 2007 or 2008. In the meantime, all projects that were in discussion but not yet finalized have been put on hold (effective early 2005).

The North Field (continued)

The minister and QP have also expressed concern over the significant increase in production planned for the north field over the next several years, and have said explicitly that more knowledge of field performance under the higher rate of production is needed before decisions are made to further increase production levels (so as not to damage long-term reservoir productivity).

Figure 8: North Field Capacity and Implied Reserve Life



Source: Simmons & Company International

Figure 9: North Field Production Capacity (Bcfed)

Liquefied Natural Gas (LNG)																	
Project	Startup	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	
QatarGas	1997	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	
QatarGas	1997	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	
QatarGas	1998	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	
QatarGas	2003						235	235	235	235	235	235	235	235	235	235	
QatarGas	2003						235	235	235	235	235	235	235	235	235	235	
QatarGas II	2008												1,669	1,669	1,669	1,669	
QatarGas II	2009												1,669	1,669	1,669	1,669	
QatarGas III	2009												1,669	1,669	1,669	1,669	
QatarGas IV	2011															1,669	
RasGas	1999		706	706	706	706	706	706	706	706	706	706	706	706	706	706	
RasGas	1999		706	706	706	706	706	706	706	706	706	706	706	706	706	706	
RasGas	2004						1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	
RasGas	2005						1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	
RasGas	2007									1,006	1,006	1,006	1,006	1,006	1,006	1,006	
RasGas	2008												1,669	1,669	1,669	1,669	
RasGas	2010												1,669	1,669	1,669	1,669	
Total (Bcfed)		856	1,284	2,696	2,696	2,696	2,696	2,696	3,402	4,429	5,456	5,456	6,461	9,799	13,137	14,806	16,474
Implied R-P		2,881	1,821	915	915	915	915	725	557	404	404	404	250	187	135	124	96

Regional Natural Gas Projects																
Project	Startup	'05	'06	'07	'08	'09	'10	'11								
Al Khaleej	2005		650	650	650	650	650	650								
Al Khaleej	Undecided								1,145							
Dolphin	2007				2,760	2,760	2,760	2,760								
Dolphin	Undecided								1,380							
Total (Bcfed)		0	0	0	0	0	0	0	650	650	3,410	3,410	3,410	5,935		

Gas-to-Liquids (GTL)														
Project	Startup	'06	'07	'08	'09	'10	'11							
Onyx	2006		n/a	n/a	n/a	n/a	n/a							
Pearl	2009							1,700	1,700	1,700	1,700	1,700		
XOM	2011											1,565		
Total (Bcfed)		0	0	0	0	0	0	0	0	0	0	1,700	1,700	3,265

Source: Simmons & Company International

Not a homogenous reservoir. With almost one-fifth of the world's natural gas potential locked in one reservoir, knowledge of the North field's reserve characteristics are important. Unfortunately, not much information is available in this regard. Simple statistics, such as the total number of wells drilled in the North field and the average production per well are not a matter of public record. Our best

information comes from two sources, the IOCs that operate projects in the North field and a few SPE papers. Even these sources are less than perfect. For instance, the IOCs who have booked reserves for the North field don't generally provide precise information on the reserves that have been recorded. This leaves our analysis heavily dependent on conversations with various IOC executives. Still, these conversations have been illuminating. For instance, we find no support for the myth that the North field is a single, large, homogenous structure. To the contrary, several industry representatives, including CEOs of two of the five largest IOCs in the world have represented that the field is complex and non-homogenous. Meanwhile, conversations with other industry representatives indicate that new assumptions have emerged about the North field structure over the past two to three years and that those assumptions imply a more complex reservoir than what was previously assumed to be the case. Non-uniformity applies to the different Khuff formations. It is generally assumed that developments to date have favored the highly productive and liquids-rich zone 4 from the Khuff formation. This leaves a higher degree of uncertainty with regard to production capabilities from the shallower three zones.

Disappointing drilling results. Three apparently unrelated individuals from three different organizations have noted that ConocoPhillips drilled an unexpected dry hole in the North field and that this event was at least a partial catalyst for a revamped perspective on the North field structure and potential. COP has no official comment on the matter. However, numbers in their financial statements leave open the possibility. Exploration costs incurred by Conoco (COP) in "Russia and Other Areas" were \$12mm, \$6mm and \$60mm in 2003, 2004 and 2005. Exploration spending expensed during these periods was \$2mm, \$5mm and \$56mm. Put differently, only \$4mm of the \$60mm of exploratory costs incurred by COP in 2005 was capitalized. Other industry sources indicate that COP spent roughly \$32mm on the rental of drilling rigs in Qatar alone in 2005. Assuming that COP carried 100% of its operating Qatari drilling costs in 2005 (a typical but undisclosed contractual term) then COP would have at the minimum expensed 88% of its drilling costs incurred in 2005. Simply put, these numbers imply that COP drilled at least one dry hole in the

The North Field (continued)

Qatar north field in 2005, seemingly confirming industry discussion on the topic.

Meanwhile, in 2005, COP recorded 1,212 bcf of natural gas reserves and 21mmboe of NGLs in this business segment, noting that these additions were primarily attributable to Qatar. These amounts equate to 33% of COP's 2005 organic reserve additions, without which COP would have reported a 67% RRR for '05. A 93% expense rate on exploration costs incurred would imply that the company is basically taking it on faith that these reserves are proven. The obvious unknown offset is what well specific information the Qataris might have provided COP in order to book these reserves. Such information is required by the SEC in order to book reserves as proven. Meanwhile, other IOC operators in Qatar have referred to the North field as one of the least delineated natural gas fields in their portfolio of proven reserves.

Indications of well productivity. Information at the individual well level for the North field is difficult to find. On occasion, development plans are announced that provide some indication on the number of wells and platforms planned for a particular stage of the North field development. SPE papers published after the first rounds of North field development provide some clues. For instance, they indicate that the Alpha platform (the first production facility in the North field, which was brought online in July, 1991) incorporated 16 wells to produce approximately 880 mmcf/d of natural gas and 40 kboed of associated liquids, implying average well productivity of 55 mmcf/d + 2.5 kboed of associated liquids from the Khuff formation, zone 4. Similarly, the Bravo complex, which supplies the first LNG liquefaction trains at QatarGas was brought online in July, 1996 produces an estimated 1.2 bcf/d of natural gas and 45 kboed of associated liquids from 20 wells (note that 24 wells were originally planned). Charlie, which supports RasGas, was brought onstream in 1998 and produces an estimated 880 mmcf/d from 15 wells. Less information is available regarding more recent expansions to the upstream supply components for QatarGas and RasGas and the Al-Khaleej gas project, although there is an indication that Al-Khaleej is designed to produce from Khuff zones 1 to 3 in addition to zone 4. Assuming similar well productivity for later stage developments to Alpha, Bravo and Charlie, then close to 100 producing wells are likely on stream in the North field.

Future development assumptions. A limited production history for the North field adds future development uncertainty. As could be expected, less information is available for future developments. Those that have been disclosed imply an apparent increase in per well productivity and a slightly higher NGL content. For instance, preliminary plans for the upstream component of the Dolphin pipeline to the UAE called for 2 bcf/d of natural gas production and 100 kboed of associated liquids from 24 production wells. Shell's Pearl GTL project plans call for 1.6 bcf/d of natural gas production and 100 kboed of associated liquids from 20 wells.

Figure 10: North Field Well Productivity

Existing	Startup	Wells	mmcf/d	kboed	mmcf/d/well	Liquids %
Alpha	1991	16	883	40	55	21%
Bravo (Qatargas)	1996	20	1,200	45	60	18%
Charlie (RasGas)	1998	15	880	40	59	21%
		51	2,963	125	58	20%
Future	Startup	Wells	mmcf/d	kboed	mmcf/d/well	Liquids %
Dolphin	2007	24	2,000	100	83	23%
Pearl GTL	2010	20	1,600	100	80	27%
		44	3,600	200	82	25%

Source: Simmons & Company International

Heavy IOC dependence on the North field. Several integrated oil companies have booked a sizeable proven reserve quantity for projects relating to the North field. While the North field presents tremendous opportunity for the International Oil Companies (IOCs) involved in its development, there remains a substantial amount of risk that long-term field performance differs from assumptions currently made by these companies. Of note, SEC standards for recording proven reserves require a 90% confidence in the quantity recorded.

- **ExxonMobil:** The company has noted that proved reserve additions associated with the Qatar North field totaled 1.6 billion boe in 2005 (accounting for 107% RRR out of a total 121% organic RRR). In 2004, North field additions totaled 1.7 billion boe. It appears as though ExxonMobil has yet to book reserves associated with its GTL project in Qatar, but has recorded a substantial amount for its interest in current and future liquefaction trains at QatarGas and RasGas.
- **ConocoPhillips:** As mentioned above, in 2005, COP recorded 1,212 bcf of natural gas reserves and 21mmboe of NGLs in this business segment, noting that these additions were primarily attributable to Qatar.

The North Field (continued)

- **Shell:** Shell signed a PSA with Qatar for the Pearl GTL facility in July, 2004. In February, 2005, the company signed a Heads of Agreement (HOA) with Qatar for construction of the 7.8 mmpa capacity QatarGas 4 liquefaction facility. Neither of these projects has been noted as a major reserve addition over the last two years, implying that Shell has yet to book reserves pertaining to their interest in the North field.
- **Total S.A.:** In 2005, Total S.A. reached an agreement in principal for the acquisition of a 16.7% interest in QatarGas II, Train 2. TOT also holds a 20% stake in the upstream operations at QatarGas and a 10% interest in the 3 QatarGas LNG liquefaction trains with a capacity of 9.7 mmpa. In December, 2001 a contract was signed for the sale of 2 bcfd of North field gas over a 25 year period to the Dolphin project, in which TOT holds a 24.5% interest.
- **Occidental:** Occidental holds a 24.5% interest in the Dolphin project. In addition, the company has been involved in the redevelopment of the Idd El Shargi North Dome (ISND) field since 1993 and Idd EL Shargi South Dome (ISSD) since 1999.

Implications of the project moratorium. In early 2005, the Qatari's issued a surprising moratorium on new North field projects. This led to a substantial amount of speculation and in some cases misinformation about the reasons behind the decision and the prospects for a second round of projects at some point in the future. However, we find that the Qatari

oil minister, H.E. Abdullah bin Hamad al-Attiyah, has delivered a clear message in this regard. His primary explanation notes the need to revisit the reservoir model of the North field, particularly in light of the prospect for sustained 25 bcfd production levels and what damage this might cause to the reservoir in the long-term. He has frequently referenced Qatar's desire to maintain 100 years of production, implying the need to increase the field's reserve estimate beyond the current 900 tcf if new projects are to be sanctioned. Qatar is expected to conclude their reservoir study in the 2007/2008 timeframe, leaving open the possibility that new projects are announced after this time.

Construction challenges. Qatar is expected to spend between \$70 and \$80 billion over the next five years on expanded operations for the North field, including related LNG and GTL facilities, not an inconsequential amount of money for a country whose annual GDP in 2005 is estimated at \$23 billion. There has been some concern that the construction market in Qatar is overheating and that many of these projects won't be complete on time or on budget as a result. While we would generally agree that some of Qatar's projects (particularly the GTL developments) have the potential to be delayed and run over budget, but we would note that the issue is global in nature and we find that the construction market in other areas (such as Canada) remains more challenging in some regards than in Qatar. Qatar for instance is close to the relatively inexpensive Southeastern Asia workforce and ready access to port infrastructure (which is in the process of being expanded).

Liquefied Natural Gas

QatarGas. QatarGas began operations in December, 1996. Formed as a joint venture between Qatar Petroleum (55%), ExxonMobil (10%), Total (10%), Mitsui (7.5%), and Marubeni (7.5%), QatarGas was the first of four similar, but separate, LNG ventures in the country. QatarGas consists of three liquefaction trains with a combined 9 mmtpa of capacity, thanks to a recent debottlenecking project that essentially added the volume of another train. QatarGas has long term contracts in place with Japanese utilities that occupy most of the project's volume.

Figure 11: QatarGas Project Summary

QatarGas									
Train	Start	Capacity		Feed (mmcfed)			Cost		
		MMTPA	mmcfed	Gas	NGLs	Total	\$mm	\$/mta	
1	1997	2.0	267	310	118	428	\$567	\$284	
2	1997	2.0	267	310	118	428	\$567	\$284	
3	1998	2.0	267	310	118	428	\$567	\$284	
D1	2003	1.1	147	171	65	235	\$67	\$61	
D2	2003	1.1	147	171	65	235	\$67	\$61	
D3	2003	1.1	147	171	65	235	\$67	\$61	
		9.3	1,240	1,442	548	1,990	\$1,902	\$205	

Source: Simmons & Company International

QatarGas II. QatarGas II represents another major LNG endeavor involving QatarPetroleum and ExxonMobil. Slated to begin operations in 2008, QatarGas II will add another 15.6 mmtpa to primarily the European market. The project will consist of two similar liquefaction trains, each with a 7.8 mmtpa capacity. France's Total recently announced that they have bought into the venture, purchasing a 16.7% interest in the second train. Reserves for the project will continue to be supplied from Qatar's North Field.

Figure 12: QatarGas II Project Summary

QatarGas II									
Train	Start	Capacity		Feed (mmcfed)			Cost		
		MMTPA	mmcfed	Gas	NGLs	Total	\$mm	\$/mta	
4	2008	7.8	1,040	1,209	460	1,669	\$2,250	\$288	
5	2009	7.8	1,040	1,209	460	1,669	\$2,250	\$288	
		15.6	2,080	2,419	919	3,338	\$4,500	\$288	

Source: Simmons & Company International

QatarGas III. QatarGas III partners Qatar Petroleum with COP in another large scale liquefaction project set to become operational in 2009. COP will have 30% ownership of the project that includes a single 7.8 mmtpa liquefaction train. The LNG will be marketed to the U.S. Gulf Coast.

Figure 13: QatarGas III Project Summary

QatarGas III									
Train	Start	Capacity		Feed (mmcfed)			Cost		
		MMTPA	mmcfed	Gas	NGLs	Total	\$mm	\$/mta	
6	2009	7.8	1,040	1,209	460	1,669	\$2,340	\$300	
		7.8	1,040	1,209	460	1,669	\$2,340	\$300	

Source: Simmons & Company International

QatarGas IV. QatarGas IV is the last of the major Qatar LNG projects currently on the drawing board. Qatar Petroleum, in a partnership with Shell (30%), will construct a liquefaction train with a capacity of 7.8 mmtpa to serve the North American and European gas markets. Production is expected to commence sometime between 2010 and 2012.

Figure 14: QatarGas IV Project Summary

QatarGas IV									
Train	Start	Capacity		Feed (mmcfed)			Cost		
		MMTPA	mmcfed	Gas	NGLs	Total	\$mm	\$/mta	
7	2011	7.8	1,040	1,209	460	1,669	\$2,340	\$300	
		7.8	1,040	1,209	460	1,669	\$2,340	\$300	

Source: Simmons & Company International

RasGas. RasGas became the second LNG project in Qatar when it opened its first liquefaction train in April 1999 with a capacity of 3.3 mmtpa. Since then, 3 trains have followed bringing its capacity to 15.2 mmtpa, with construction plans calling for an additional three more trains. When it is complete RasGas will export over 36 mmtpa to markets across the world. Ownership for the trains is primarily split between QatarPetroleum and ExxonMobil (XOM), with the Asian utilities sharing a small portion of the first two trains.

Figure 15: RasGas Project Summary

RasGas									
Train	Start	Capacity		Feed (mmcfed)			Cost		
		MMTPA	mmcfed	Gas	NGLs	Total	\$mm	\$/mta	
1	1999	3.3	440	512	194	706	\$1,650	\$500	
2	1999	3.3	440	512	194	706	\$1,650	\$500	
3	2004	4.8	640	744	283	1,027	\$1,300	\$271	
4	2005	4.8	640	744	283	1,027	\$1,300	\$271	
5	2007	4.7	627	729	277	1,006	\$1,300	\$277	
6	2008	7.8	1,040	1,209	460	1,669	\$2,250	\$288	
7	2010	7.8	1,040	1,209	460	1,669	\$2,250	\$288	
		36.5	4,867	5,659	2,150	7,809	\$11,700	\$321	

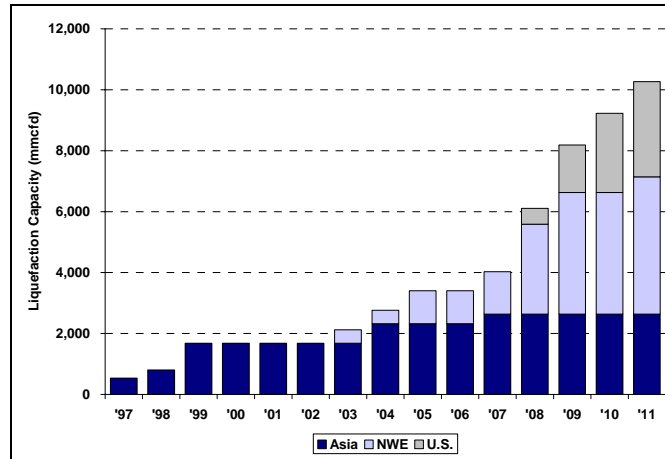
Source: Simmons & Company International

Liquefied Natural Gas (continued)

LNG Trade. North field LNG projects are expected to account for roughly one-third of the global increase in liquefaction capacity between now and 2015, adding an incremental 7.5 bcfd by early next decade. Based on current

announced plans, approximately ¼ of global LNG volumes in 2011 will be sourced from Qatar, roughly doubling the country’s market share of global LNG trade.

Figure 16: Qatari LNG Supplies by Designated Market



Source: Simmons & Company International

mmcf/d	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11
Asia	533	800	1,680	1,680	1,680	1,680	1,680	2,320	2,320	2,320	2,633	2,633	2,633	2,633	2,633
NWE	0	0	0	0	0	0	440	440	1,080	1,080	1,393	2,953	3,993	3,993	4,513
U.S.	0	0	0	0	0	0	0	0	0	0	0	520	1,560	2,600	3,120
	533	800	1,680	1,680	1,680	1,680	2,120	2,760	3,400	3,400	4,027	6,107	8,187	9,227	10,267
%	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11
Asia	100%	100%	100%	100%	100%	100%	79%	84%	68%	68%	65%	43%	32%	29%	26%
NWE	0%	0%	0%	0%	0%	0%	21%	16%	32%	32%	35%	48%	49%	43%	44%
U.S.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	19%	28%	30%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: Simmons & Company International

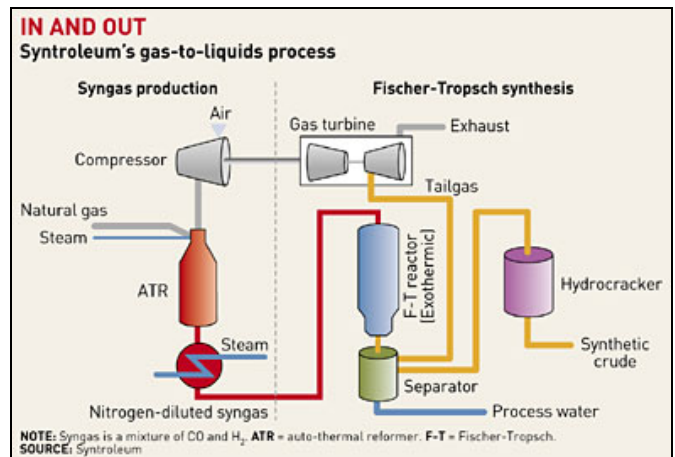
GTL Process. Multiple GTL technologies are available and employed by the operators of would be GTL plants. The most significant distinguishing characteristic between these technologies is the choice of catalyst used in the Fischer-Tropsch (F-T) process. Most technologies involve three stages:

- **STEP 1: Syngas Production:** Synthesis gas (Syngas) is generally produced in one of two ways, both use CH₄ (methane) as a primary feedstock:
 - **Partial Oxidation.** In this method, CH₄ (Methane) is partially oxidized, i.e.-burned, to generate CO₂ + H₂ (syngas). First, O₂ is separated from the atmosphere, then mixed with CH₄ in restricted quantities in the presence of heat so as to promote partial, but not full oxidation.
 - **Steam Reforming:** Uses heat + a catalyst to reform methane into CO₂ + H₂ (syngas)

The creation of syngas is an endothermic and capital intensive process. By some estimates, approximately 60-70% of the capital cost in a GTL plant is spent on units leading up to the creation of a synthesis gas.

- **STEP 2: Fischer-Tropsch (FT):** The FT process employs the use of a catalyst to convert syngas into hydrocarbons and water. The process is highly exothermic, a nice match for the endothermic syngas production process. Different FT catalysts, temperature and pressures produce varying yields of gasoline, naphtha diesel and wax. The most recent iterations of GTL technology opt for a high production of diesel and wax.
- **STEP 3: Hydrocracking.** Breaks long-chain hydrocarbons into smaller, high value diesel output.

Figure 17: GTL Process Diagram



Source: Syntroleum

Why the Qatari's have opted for GTL. There is a general belief that under historical and present market prices for natural gas and diesel and current cost assumptions for LNG facilities and GTL plants that LNG offers a higher netback per unit of natural gas production. This begs the question as to why the Qatari's have committed to send 3,730 mscfd of natural gas production from the North field into GTL plants instead of through LNG. We believe there is a two-part explanation for this:

- **Market Diversification:** On current plans, LNG projects sourced from the Qatar North field are expected to account for 1/3rd of the world's LNG growth between now and 2015. For reference, at its current planned peak dry gas output capacity of 20 bcfed (including LNG projects, GTL feedstock and regional natural gas pipeline projects), the North field would equate to close to 100% of current global LNG trade. Such market dominance has its benefits, particularly under the base case forecast scenario for a world short of needed LNG cargos. However, the Qatari's desire to manage the North field production for 100 years leads them to want some market diversification. GTL diesel offers a reasonable solution in this regard, since planned output from the North field is much smaller in relation to the liquid hydrocarbon market, with peak dry gas output equating to less than 10% of the world's total current consumption of middle distillates.

- IOC Capital Funding:** Economic costs are higher for GTL plants than for LNG plants. Comparison is difficult, given that two different markets are being exploited (one natgas, one being diesel). However, we don't believe it to be coincidental that Shell and ExxonMobil's large scale GTL plants will be 100% IOC funded, whereas capital spending on existing and future LNG liquefaction trains is shared between the QP, the NOC, and partner IOCs.

Oryx. The Oryx GTL plant is Qatar's first, having been officially established in January, 2003 as a JV between QP and Sasol with startup planned for June, 2006. The facility has two trains and a total GTL product capacity of 34 kbd (including approximately 24 kbd of ultra-clean diesel, 9 kbd of naphtha and 1 kbd of LPG). As feedstock, the plant uses 330 mmcf of natural gas processed from the ExxonMobil-operated Al Khaleej regional gas project. Oryx is also reliant on common utility supplies available at Ras Laffan. Gross capital costs are estimated at \$1 billion (25% above prior budget). As a non-integrated project aided by the support of regional gas supplies and shared utilities, Oryx is afforded unit capital cost savings believed to make unit economics significantly more attractive than would otherwise be the case. These savings, combined with recent trends in EPC contractor and raw material costs going forward are expected to put the next two GTL projects at a cost disadvantage relative to the Oryx plant. While in Qatar, we spoke with several industry representatives who are looking to the successful startup of the Oryx project (the first commercial scale GTL plant in the Middle East) as a positive sign for the potential of the Shell and ExxonMobil projects.

Figure 18: Oryx GTL Project Summary

Oryx GTL	
Startup	2006
Feed (mmcf)	330
Associated Liquids (kboed)	n/a
Total E&P Production (mmcf)	330
Product Yield (kbd)	34
Cost (\$mm)	\$1,000
Cost (\$/bd)	\$29,412

Source: Simmons & Company International

Pearl. Shell signed a Development and Production Sharing Agreement (DPSA) in July, 2004 for the construction of a 140 kbd GTL facility. Initial cost estimates were \$5 billion, but have grown to \$6.3 billion with the expectation of further increases before Final Investment Decision (FID) is made later this year (2006). The project is an integrated upstream/downstream development, involving two offshore platforms and 1,600 mmcf of natural gas feed into the GTL facility with 100 kbd of associated condensate and NGL production. Output from the plant is expected to be 140 kbd. Construction is anticipated to occur in two stages, with stage one set to come online around 2010 at 70 kbd. Stage 2 startup is to come one year later. Shell has shot 3D seismic over their allocated North field block and drilled 2 wells to delineate the upstream resource in February, 2004. Shell's "Pearl" facility is scheduled to be the second GTL plant in Qatar. With an output capacity over 4x the Oryx plant, Pearl GTL is expected to be the largest construction project in Qatar, occupying a land mass equivalent to 450 football fields and requiring a peak construction workforce of 15,000. Approximately 600 – 1,000 employees will be required to operate the plant.

Figure 19: Pearl GTL Project Summary

Pearl GTL	
Startup	2010-11
Feed (mmcf)	1,600
Associated Liquids (kboed)	100
Total E&P Production (mmcf)	2,200
Product Yield (kbd)	140
Cost (\$mm)	\$6,300
Cost (\$/bd)	\$45,000

Source: Simmons & Company International

ExxonMobil. ExxonMobil's proposed GTL facility is the largest and last GTL project to receive preliminary approval from the Qatari's. A Heads of Agreement (HOA) was signed in July, 2004 specifying the principle terms to be defined in a future DPSA. At the time, ExxonMobil estimated total project costs at \$7 billion (recent quotes from third party sources indicate current consolidated cost estimates could be closer to \$7.8 billion). The DPSA is anticipated to be 25 years in length commencing with first GTL production in 2011. ExxonMobil will fund 100% of the project capital requirements.

The project will include integrated upstream facilities, which are to supply the required 1,800 mmcf/d of natural gas feedstock in addition to 165 kbd of associated liquids.

Figure 20: ExxonMobil GTL Project Summary

ExxonMobil GTL	
Startup	2011
Feed (mmcf/d)	1,800
Associated Liquids (kboed)	165
Total E&P Production (mmcf/d)	2,790
Product Yield (kbd)	154
Cost (\$mm)	\$7,800
Cost (\$/bd)	\$50,649

Source: Simmons & Company International

Honorable mentions. Only the Oryx, Pearl and ExxonMobil GTL facilities appear to have made the 25 bcf/d cut-off. Other projects have been mentioned, but do not appear to have won preliminary approval. These include:

- **Marathon:** Proposed GTL project with output capacity of 120 kbd from two equal-sized trains. Potential partners included PetroCanada and Occidental.
- **ConocoPhillips:** Proposed two stage GTL project. A feasibility study was submitted in mid-2003.

Regional Pipeline Projects

Regional pipeline options have progressed much slower than LNG projects. Qatar has in the past discussed several options for regional natural gas pipelines. However, to-date only one has been fully sanctioned and begun construction (the Dolphin project linking the North field to the UAE.) Other options discussed but not implemented include a natural gas grid heading north to Bahrain and Kuwait and a subsea extension to the Dolphin gas line into Pakistan. Political hurdles have been significant for these developments, tending to slow their progress. In addition, there is some concern that the netback afforded the Qatari's from regional pipeline initiatives (\$1.30/mmbtu for Dolphin, for instance) is substantially below the unit netback afforded the Qatari's through their LNG export strategies.

Dolphin. The Dolphin project involves a pipeline from Qatar to the UAE with supplies sourced from the North field. Initial design capacity is 2 bcf/d. Total spending for the initial stage is estimated at \$4 billion. Project partner Occidental expects first gas late in '06, with a ramp towards full production by mid-2007. Long-term expansion plans are expected to bring total pipeline capacity to 3.2 bcf/d, with some of the increment potentially used to power an Omani steamflood project operated by Occidental.

Al Khaleej. ExxonMobil is operating the Al Khaleej natural gas development, which adds additional natural gas supply to the domestic market for Qatar. First volumes from the initial stage were delivered in November, 2005. Gross peak capacity for this stage is 675 mmcf/d of natural gas and 40 kbd of associated liquids. Future phases are expected to add 1,140 mmcf/d and 70 kbd.

Vision of a regional gas pipeline grid. In early 2002, the Qataris signed a preliminary agreement with Kuwait for a \$2 billion subsea gas pipeline to deliver natural gas from the North field to Kuwait. Expectations at the time were for delivery of first gas to begin in 4Q'05 and last 25 years. Initial volumes were envisioned at 800 mmcf/d, rising to 1.4 bcf/d in the long-term. At the same time, a Memorandum of Understanding (MOU) was signed with Bahrain to allow the country 500 mmcf/d of initial volumes from the new regional natural gas line, rising to 800 mmcf/d long-term. These preliminary agreements sat un-finalized for quite some time. In February, 2006 it was announced that the Kuwait natural gas line would not proceed on the basis that Saudi Arabia would not permit the line to cross their maritime borders. Perhaps more interesting are coinciding comments from the Qatari oil minister that no natural gas was available for this line anyway due to sizeable commitments on other projects.

Appendix D

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