LNG & LPG Shipping Fundamentals

June 2013

Jefferies LLC

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Topics For Discussion

LNG Shipping:

- What Is LNG And LNG Shipping?
- LNG Shipping Charter Rates/Asset Values
- LNG Shipping Demand Fundamentals
- What About The US?
- LNG Shipping Supply Fundamentals
- LNG Shipping Supply/Demand Model

LPG Shipping:

- What Is LPG and LPG Shipping?
- LPG Shipping Charter Rates/Asset Values
- LPG Shipping Demand Fundamentals
- The US As A Potential Game Changer
- LPG Shipping Supply Fundamentals
- LPG Shipping Supply/Demand Model

What is LNG and LNG shipping?

Liquefied natural gas (LNG) provides a cost-effective means for transporting natural gas overseas by super-cooling it to a liquid form, reducing its volume by approximately 1/600th of its gaseous state. The LNG shipping industry continues to grow rapidly with global demand for LNG expected to increase by more than 50 percent by 2030.

- **Liquefaction – Natural gas is super cooled to a liquid state at approximately -260 degrees Fahrenheit at a liquefaction facility while reducing the volume to 1/600th of its original volume allowing for economic transportation.**

- **Shipping – LNG shipped from liquefaction facilities to import terminals or FSRUs on specialized ships with containment systems to insulate the LNG in its liquid form.**

- **Regasification – LNG is returned to its gaseous state either at a land based regasification terminal or a floating storage and regasification unit (FSRU) and delivered to end users via pipeline.**

- **Economics – Costs include liquefaction costs of ~$3.00/MMBTU, shipping/fuel costs of ~$1.50-$3.50/MMBTU, and the cost of the gas at ~$4.00/MMBTU in a low cost region for a total delivered cost of ~$8.50-$10.50/MMBTU relative to a market price of ~$12-$15/MMBTU in Europe and Asia based on $100/barrel crude oil as gas in Europe and Asia is typically priced at 11-15% of the price of crude on an energy equivalent basis.**

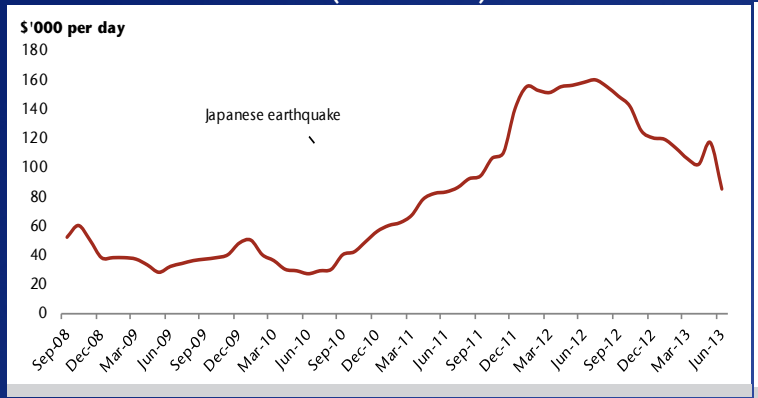
LNG Shipping Market Analysis – Charter Rates/Asset Values

- **Short-term LNG charter rates have risen since 2010 due to increased global liquefaction capacity although short-term charter rates have softened in recent months due to a series of "one off" disruptions.**

- **Newbuilding orders for new LNG carriers have increased since the lows of 2008-2010 but have failed to keep pace with anticipated LNG shipping demand growth due to difficult bank financing conditions and limited LNG shipbuilding capacity.**

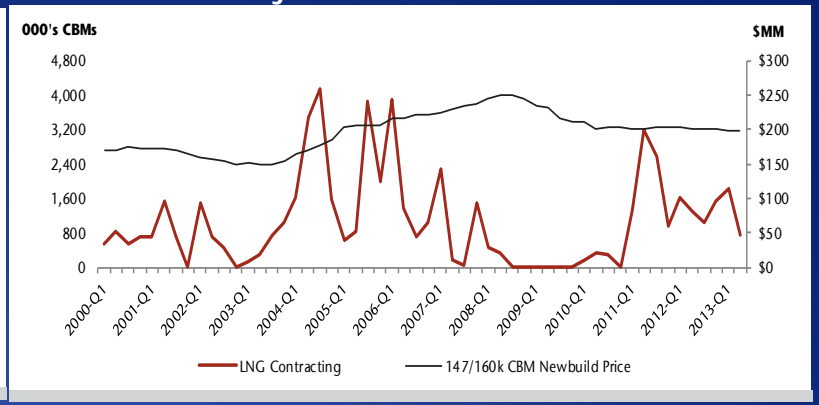
- **Newbuilding asset values have remained essentially unchanged since 2009 at approximately $200 million per vessel despite the increase in ordering that began in 2011 as shipyards still struggle with the broader shipping industry.**

LNG short term timecharter rates (138-145k cbm)



Source: Fearnley's Research, Jefferies estimates

LNG Newbuild Contracting And Prices



Source: Clarksons Research

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LNG Shipping Market Analysis – LNG Shipping Demand Fundamentals

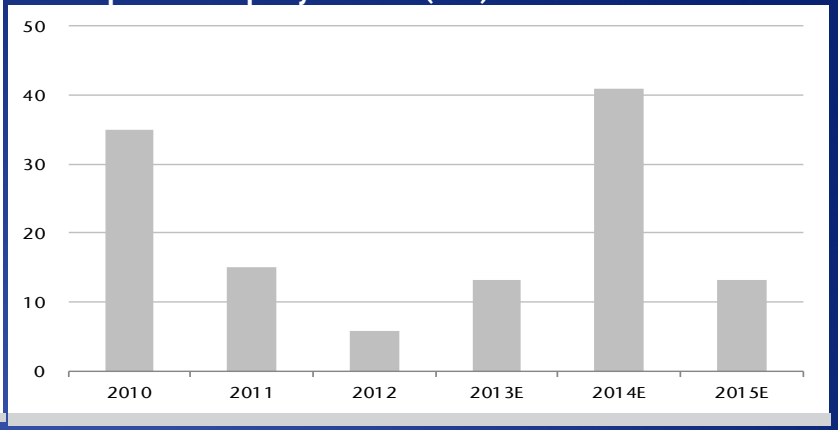
- Natural gas demand in Asia expected to continue to strengthen
- Low cost LNG producers at an advantage to meet increasing natural gas demand
- Limited new liquefaction capacity scheduled to come online in 2013
- Significant liquefaction capacity to come online in 2014/2015 timeframe
- Every incremental 1 bcm per annum requires 1.5-2 LNG carriers to service
- Development timelines will be key as delays are the single biggest risk to LNG shipping

Global LNG Project Status

Country	Project	Capacity (bcm)	Online date
Algeria	Skikda new train	6.1	1Q13
Angola	Angola LNG	7.1	3Q13
Australia	Gorgon LNG	20.4	4Q14
Papua New Guinea	PNG LNG	9	2014
Australia	Queensland Curtis LNG	11.6	3Q14
Indonesia	Donggi Sennoro LNG	2.7	2015
Australia	Gladstone LNG	10.6	2015
USA	Sabine Pass	22.7	2016/2018
Australia	Australia Pacific LNG	6.1	2016
Australia	Wheatstone LNG	12.1	2016
Australia	Prelude LNG	4.9	2017
Australia	Ichthvs LNG	11.4	2018
USA	Freeport LNG	14.3	2018
Canada	Kitimat	6.7	2018
Total		145.7	

Source: IEA, Waterborne Energy, Jefferies estimates

Global Liquefaction Capacity Additions (bcm)



Source: IEA, Waterborne Energy, Jefferies estimates

LNG Shipping Market Analysis – What about the US?

- The US has the potential to be a significant LNG exporter
- Only 2 liquefaction projects have been approved so far (Sabine Pass and Freeport)
- Additional approval decisions likely throughout 2013 and 2014; 10 already applied for FERC approval
- Additional approvals would be very material to the LNG shipping market
- Sabine Pass will require ~24 LNG carriers to service while Freeport will require ~14 LNG carriers to service

US LNG Projects Under DOE Review

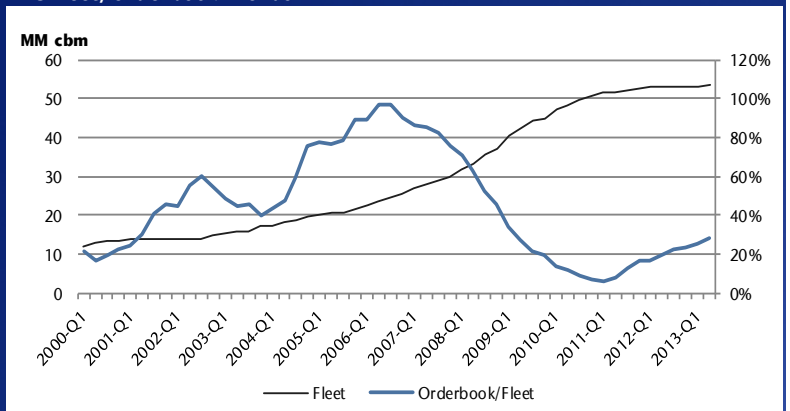
Project	Capacity (bcf/d)	Status	Online date
Sabine Pass	2.2	Approved	2016
Freeport LNG	2.8	Partial Approval	2018
Lake Charles	2.0	Under Review	
Dominion Cove	1.0	Under Review	
Cameron LNG	1.7	Under Review	
Jordon Cove Energy	1.2	Under Review	
LNG Dev. Co. - Oregon LNG	1.3	Under Review	
Corpus Christi	1.8	Under Review	
Excelerate IQ Solutions	1.4	Under Review	
Carib Energy	0.0	Under Review	
Gulf Coast LNG	2.8	Under Review	
Southern LNG - Elba Island	0.5	Under Review	
Gulf LNG (Miss)	1.5	Under Review	
CE FLNG	1.1	Under Review	
Golden Pass	2.6	Under Review	
Main Pass	3.2	Under Review	
Waller Point LNG	0.2	Under Review	
Pangea LNG	1.1	Under Review	
Magnolia LNG	0.5	Under Review	
Total	28.94		

Source: IEA, Waterborne Energy, Jefferies estimates

LNG Shipping Market Analysis — LNG Shipping Supply Fundamentals

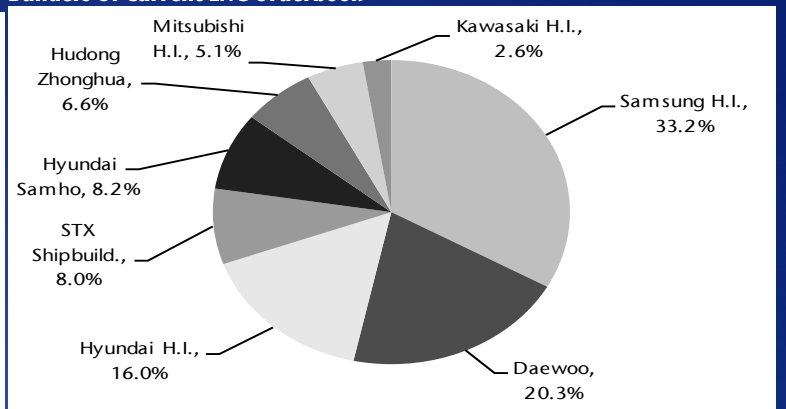
- **LNG carrier current orderbook/fleet ratio remains below average levels at ~28.5% of existing fleet**
- **Speculative ordering remains limited due to significant capital requirements, limited bank financing availability, and technical expertise required**
- **Relatively few shipyards possess technical know-how to build an LNG ship; existing newbuilding orders placed at only 8 shipyards.**
- **China has yet to get up the learning curving on building LNG ships with just 1yard building ships and at a higher cost than South Korean builders.**

LNG Fleet/Orderbook Trends



Source: Clarksons Research

Builders Of Current LNG Orderbook



Source: Clarksons

LNG Shipping Market Analysis – LNG Shipping Supply/Demand Model

Shipping Supply/Demand Fundamentals ('000 cbm)

	2006	2007	2008	2009	2010	2011	2012	2013E	2014E	2015E
LNG Liquefaction Capacity (MMcm)	240,000	255,000	265,000	325,000	360,000	375,000	380,900	394,100	435,100	448,400
LNG Trade Growth (MMcm)	220,000	240,000	240,000	250,000	300,000	325,000	318,500	354,690	391,590	403,560
Liquefaction Utilization	92%	94%	91%	77%	83%	87%	84%	90%	90%	90%
LNG Trade Growth (MMcm)		20,000	-	10,000	50,000	25,000	(6,500)	36,190	36,900	11,970
Additional LNG Carriers Required		23	-	11	57	29	(7)	38	38	12
LNG Fleet	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013E**	**2014E**	**2015E**
Beginning balance	22,794.6	26,791.5	31,558.4	40,264.5	47,211.5	51,516.9	53,124.4	53,196.1	56,402.9	60,498.2
Deliveries	3,996.9	4,796.3	9,119.0	7,211.1	4,433.8	1,832.7	323.1	3,356.8	4,245.4	4,711.1
Demolition/Losses/Removals	-	29.4	412.9	264.1	128.4	225.2	251.4	150.0	150.0	150.0
Ending Balance	26,791.5	31,558.4	40,264.5	47,211.5	51,516.9	53,124.4	53,196.1	56,402.9	60,498.2	65,059.3
Fleet Growth	3,996.9	4,766.9	8,706.1	6,947.0	4,305.4	1,607.5	71.7	3,206.8	4,095.4	4,561.1
% Change	17.5%	17.8%	27.6%	17.3%	9.1%	3.1%	0.1%	6.0%	7.3%	7.5%
Additional LNG Vessels Delivered		33	60	48	30	11	0	20	26	29
Vessel (Shortage)/Surplus		**10**	**60**	**36**	**(28)**	**(18)**	**7**	**(18)**	**(13)**	**16**

What is LPG and LPG shipping?

Liquefied petroleum gas (LPG) includes propane, butane, butadiene, isopropane, propylene, and vinyl chloride monomer, which are all by-products of the production of oil and natural gas. LPGs have a variety of uses including as a cooking/heating fuel, refinery feedstock, automotive power, and numerous other plastics and chemicals applications.

- Fractionation – Raw natural gas is processed to remove acid gases, after which a liquid stream is extracted, which is then fractionated to produce propane and butane along with other LPG products. Alternatively, LPGs are produced as a by-product of the crude oil refining process, which accounts for about 40% of LPG production.

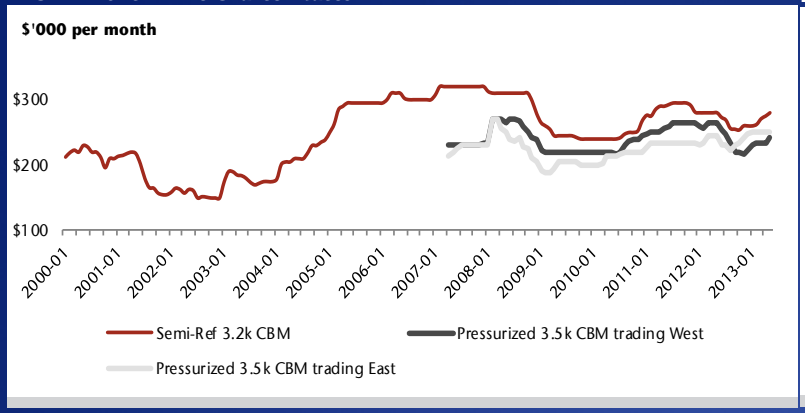
- Shipping – LPG is shipped in liquid form to keep the volume small and facilitate handling using either pressurized or refrigerated ships to keep the gas in liquid form.

- Distribution – LPG is distributed for end use via either a pipeline for areas that have the infrastructure or via tankers/canisters where infrastructure is less developed. It is the ability to distribute LPG in small quantities in remote areas that makes LPG a particularly attractive cooking/heating fuel in emerging market countries.

LPG Shipping Market Analysis – Charter Rates/Asset Values

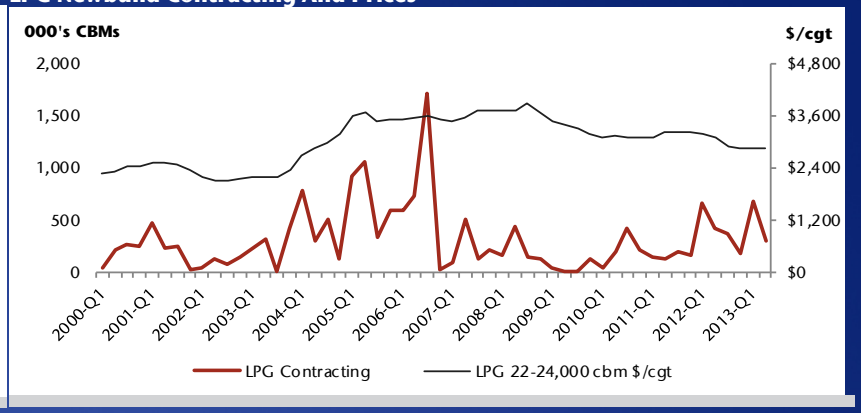
- **LPG shipping charter rates have been increasing YTD as a result of robust demand growth for LPG products in emerging markets and increased LPG supplies available for shipping which has outpaced LPG shipping fleet growth**
- **Newbuilding orders for new LPG tankers have remained minimal due to difficult bank financing conditions and limited LPG shipbuilding capacity**
- **Newbuilding asset values have remained fairly flat on a $/cgt basis and represent attractive opportunities to earn attractive returns given the recent upward trajectory of LPG shipping charter rates**

LPG 12-month Time Charter Rates



Source: Clarksons Research

LPG Newbuild Contracting And Prices

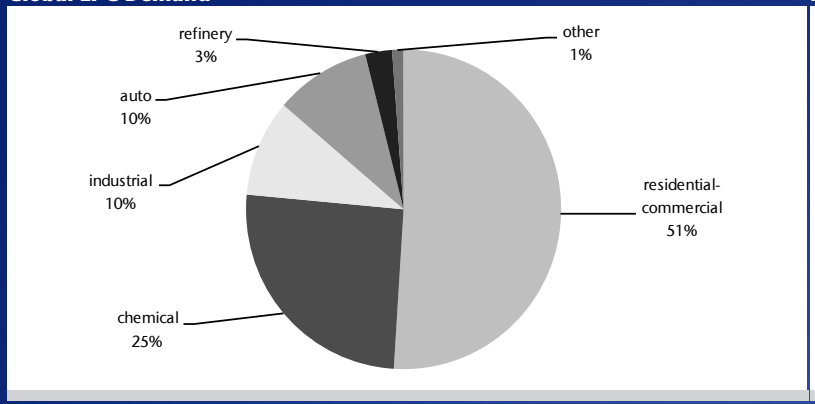


Source: Clarksons Research

LPG Shipping Market Analysis – LPG Shipping Demand Fundamentals

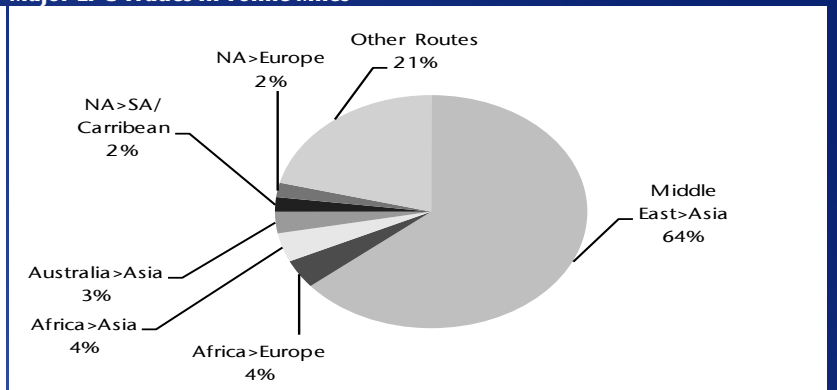
- LPGs have a wide variety of applications with use as a cooking/heating fuel in emerging markets being the most prevalent
- Asian demand dominates the trade
- The majority of LPG production is sourced from the Middle East with LPG being a by-product of oil and gas production
- Middle East LPG production expected to grow 9% per annum in 2013 and 2014, which should allow the region to continue to satisfy demand growth

Global LPG Demand



Source: Purvin & Gertz Inc.

Major LPG Trades In Tonne Miles



Source: IHS Global Insight, Danish Ship Finance

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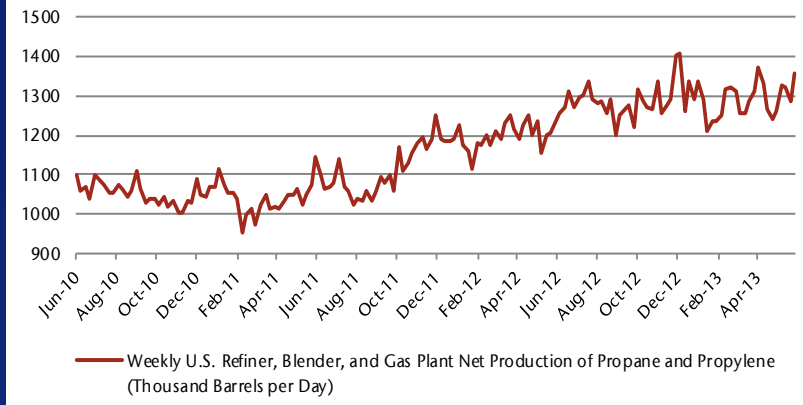
LPG Shipping Market Analysis – The US As A Potential Game Changer

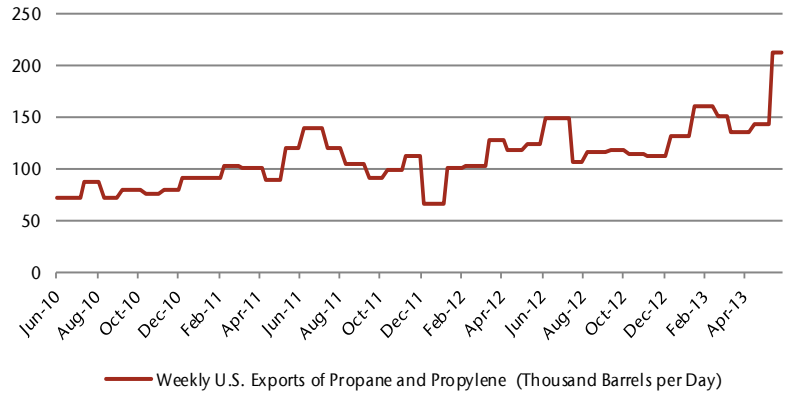
- LPG exports represent an attractive opportunity for US producers to profitably make use of immense shale gas reserves
- US Coast Guard confirmed in June 2012 that pressurized vessel owners would be able to load propane in the US making the export of LPGs much easier than the export of LNG which is mired in regulatory red tape
- US propane/propylene production has surged along with natural gas production over the past couple of years
- Increasing US LPG export capacity enabling increasing LPG production to be shipped from the US in increasing quantities NOW

US Propane and Propylene production



Source: EIA

US Propane and Propylene Exports



Source: EIA

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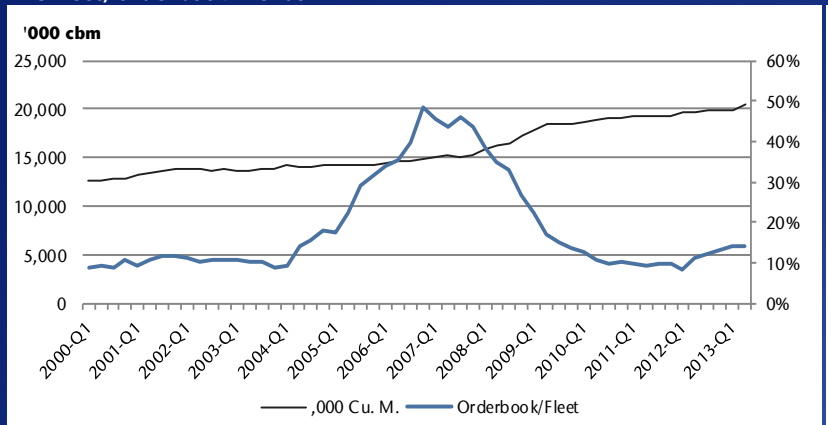
LPG Shipping Market Analysis – LPG Shipping Supply Fundamentals

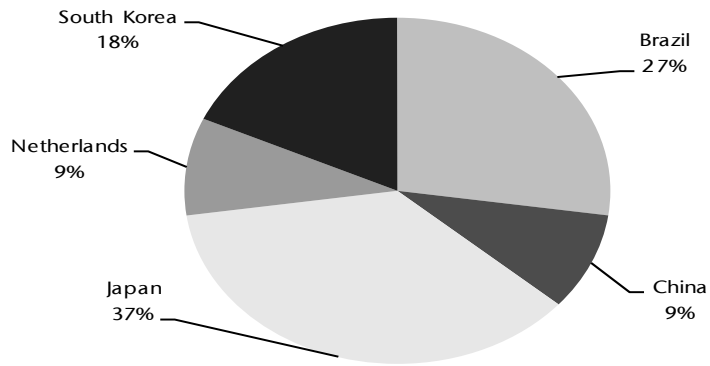
- **Orderbook/Fleet ratio remains at modest levels of 14-15% despite attractive outlook**
- **Speculative ordering remains limited due to limited availability of capital and the technical know-how to be a competitor in the LPG shipping space**
- **Relatively few shipyards possess the technical know-how/desire to build LPG carriers; existing newbuilding orders for small pressurized carriers placed at only 11 shipyards**
- **LPG shipbuilding is a niche, high value segment historically dominated by Japanese builders with limited emerging competition from China**

LPG Fleet/Orderbook Trends



Source: Clarksons Research

LPG Pressurized Orderbook Builders



Source: Clarksons Research

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LPG Shipping Market Analysis – LPG Shipping Supply/Demand Model

Shipping Supply/Demand Fundamentals ('000 cbm)

LPG Fleet	2006	2007	2008	2009	2010	2011	2012	2013E	2014E	2015E
Beginning balance	14,463.9	15,137.4	15,868.3	17,941.9	18,693.1	19,331.9	19,618.2	19,946.8	21,258.8	22,539.8
Deliveries	944.9	1,431.7	2,860.7	1,725.9	1,315.5	678.1	409.7	1,462.0	1,431.0	741.0
Demolition/Losses/Removals	271.4	700.9	787.0	974.7	676.8	391.8	81.1	150.0	150.0	200.0
Ending Balance	15,137.4	15,868.3	17,941.9	18,693.1	19,331.9	19,618.2	19,946.8	21,258.8	22,539.8	23,080.8
Fleet Growth	673.5	730.9	2,073.6	751.2	638.8	286.3	328.6	1,312.0	1,281.0	541.0
% Change	4.7%	4.8%	13.1%	4.2%	3.4%	1.5%	1.7%	6.6%	6.0%	2.4%
LPG Seaborne Demand Growth			4.0%	-18.0%	-2.0%	13.0%	10.0%	8.0%	8.0%	8.0%
LPG Fleet Growth			13.1%	4.2%	3.4%	1.5%	1.7%	6.6%	6.0%	2.4%
(% Undersupplied)/Oversupplied			**9.1%**	**22.2%**	**5.4%**	**(11.5%)**	**(8.3%)**	**(1.4%)**	**(2.0%)**	**(5.6%)**

Source: Clarksons Research, IHS Global Insight, Danish Ship Finance, Jefferies estimates

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