PARADISE
GAS CARRIERS

LPG Market Review

December 2017

Gas Production, Transportation & End Uses Chain

PARADISE GAS CARRIERS

Natural Gas Processing

Raw Natural Gas

Crude Oil

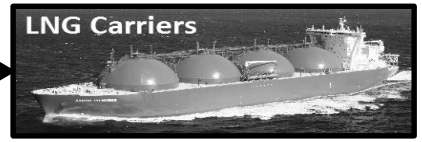
Petroleum Refinery

Methane

Propane
Butane

Ethane

Propane
Butane



LPG = Propane and/or Butane

STEAM CRACKER

Feedstocks versus yields of intermediate petrochemical

	Feedstock Source	Product Yields				
		Ethylene	Propylene	Butadiene	Aromatics *1	Other *2
Gas	Ethane	84%	1%	1%	1%	13%
	Propane	45%	14%	2%	4%	35%
	Butane	44%	17%	3%	3%	33%
Liquid	Naphtha *3	34%	14%	5%	14%	33%
	Gas Oil *4	26%	14%	5%	13%	42%

*1: Includes benzene, toluene, xylenes and any other aromatics

*2: Includes hydrogen, methane, butenes, non-aromatic portion of pyrolysis gasoline & fuel oil

*3: Ful-range naphtha (as different from light or heavy naphtha)

*4: Portion of pteroleum crude oil with boiling range 250-550 celcius (encompasses also range for AGO & VGO)

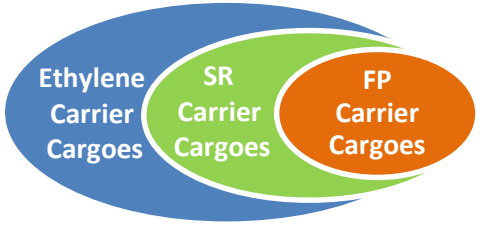
US Pvt Equity darling story

Butenes & Butadiene Butylene VCM

Propylene

Ethylene

Petrochemicals



LPG (Propane & Butane) Uses:

People use propane in and around their homes for furnaces, water heaters, air conditioners, outdoor grills, fireplaces, and appliances. On farms, propane-fueled equipment and technologies control pests, dry crops, and power irrigation pumps. Industrial uses include propane-driven forklifts and fleet vehicles. And millions of commercial establishments, including restaurants and hotels, depend on propane for heating, cooking, and other uses. Cooking: Gas Grills, Stovetops. Drying: Clothes Dryers. Heating: Hot Water Heaters, Furnaces, Fireplaces, Space Heaters, Pool Heat, Patio Heaters, Temporary Heaters. Lighting: Outdoor Lighting. Landscaping: Lawn Mowers. Pest Control: Insect Control. Materials Handling: Forklifts. Driving: Commercial Motor Fleets. Crop Management: Moisture Control, Grain Dryers

Butanes, Butylenes, Butadiene & Derivatives Uses:

DOMESTICS (space heating, cooking, lighting, hot water supply and refrigeration). LEISURE (caravans and boats, barbecues and green houses, camping and outdoor activities, blow lamps and other hand tools). INDUSTRIAL (wedding, jewerly making/soldering, aerosol, propellants). AUTOMOTIVE (fuel for fork lift, truck, cars, taxis, and other vehicles which operate within a restricted radius of their base depots). TIRES AND TIRE PRODUCTS, HOSES AND BELTS, RUBBER GOODS, FOOTWARE, ADHESIVES & CEMENTS, SEALANT ADDITIVES, MOLDED PRODUCTS, LATEX FOAMS, LATEX PAINTS, WIRE AND CABLE COATINGS, COATED FABRICS, CARPET SEALANTS, CAULKING COMPOUND, ADHESIVES, TIRE BACKINGS. PRODUCTS, LUBE VISCOSITY IMPROVER, ADSORBENT FIBER, PIPE FABRICATION, SOLVENT (e.g., vinyl coatings, acrylic coating). PAPER AND INK MANUFACTURER, LUBE OIL DEWAXING.

PROPYLENE & Derivatives Uses: RUBBING ALCOHOL, PHARMACEUTICALS, COATING. SOLVENTS, PERSONAL CARE PRODUCTS, AEROSOLS, CHEMICAL INTERMEDIATES: plastics and rubber products. CARPETING, BRUSHES, ROPE, TAPE, TOYS, NON-WOVEN FIBER, PLASTIC BOTTLES, BOXES, APPLIANCE PARTS, PROTECTIVE COATING IN LATEX PAINTS, ADHESIVES, INK SOLVENTS, EXTRACTED SOLVENTS for oils, perfumes, drugs. PLASTICS, LEATHER SOLVENTS, COATED PAPER & TEXTILES, APPAREL, CARPET, DRAPERIES, & CURTAINS, AWNINGS & BLANKETS, HOME FURNISHINGS, PAINT ROLLERS, SPEAKER GRILLS, BATTERY SEPARATORS, PIPE & FITTINGS, AUTOMOTIVE PARTS, APPLIANCE PARTS, BUSINESS MACHINES, TELEPHONES, PACKAGING, LUGGAGE, TOYS, MEDICAL DISPOSABLES, INDUSTRIAL PARTS, BOXES & CONTAINERS, POLYURETHANE FOAM, FIBERGLASS COMPOSITES, FOOD FUMIGANT, CHEMICAL NTERMEDIATE, DETERGENTS, SOLVENT, ANTIFREEZE, HUMECTANT (creams, lotions, moisturizers), PRESERVATIVES, LUBRICANTS, SOFTENING AGENT, COSMETICS, HYDRAULIC FLUID, CUTTING OIL, SUNTAN LOTION, PHARMACEUTICALS, PAPER, CEMENTS, CERAMICS, DISPOSABLE DIAPERS, FLOOR POLISH.

ETHYLENE & Derivatives Uses: PACKAGING FILM, PLASTICS BAGS, MILK BOTTLES, OIL CANS, FUEL TANKS, CAPS AND LIDS, INSULATION, PIPES & TUBINGS, DIAPER COVERS, HOUSEWARES, TOYS, CO-MONOMER (Linear Low Density Polyethylene), SYNTHETIC LUBES, CHEMICAL INTERMEDIATE, DETERGENT, PAPER & TEXTILE, WAX SUBSTITUTE, OIL FIELD CHEMICALS, MOLD RELEASE, PLASTICIZER, LEATHER TREATING, CEMENT ADDITIVES, COSMETICS, CORROSION INHIBITER, PHOTO CHEMICALS, NONIONIC SURFACTANT, FUMIGANT, STERILIZING AGENT, PHARMACEUTICALS, LATEX PAINTS, ANTIFREEZE, POLYESTER FIBER & RESIN, BRAKE FLUID, HYDRAULIC FLUID, FIBER (apparel, household, non-woven, draperies). PLASTICS, LACQUER, ASPIRIN, FRAGRANCES, PHARMACEUTICALS, CHEMICAL INTERMEDIATE, STARCH MODIFIER, SOLVENTS (e.g., coatings, plastics, general purpose. COSMETICS, TOILETRIES, MEDICAL APPLICATIONS, CHEMICAL FEEDSTOCKS, GASOHOL, FLAVORS, MOUTHWASH, WOOD GLUE.

Modes of Seaborne LPG Transport

- The efficiency lies in significant volume reduction; to the tune of 600 times.
- Volume reduction involves liquefaction from gas to liquid state (unlike Rick Moranis who somehow maintained solid state throughout the process).
- Achieved and then maintained by **Pressure** and/or **Refrigiration**.

Depending on which method(s) are used, ship types are defined as follows:

- **Fully Pressurized (FP)**

Pressures alone used to maintain liquid state. Some FP ships can load down to -10 but no cooling to maintain. Maximum pressures typically of 18 bar. Size of up to approximately 12,000 cbm.

- **Semi Refrigerated (SR)**

Utilize a combination of pressure and refrigeration. Capacity is as large as 22,000 cbm. Typically they maintain cargo down to -48°C, under pressures of 4-8 bar maximum (the smaller ships have higher pressures and vice versa).

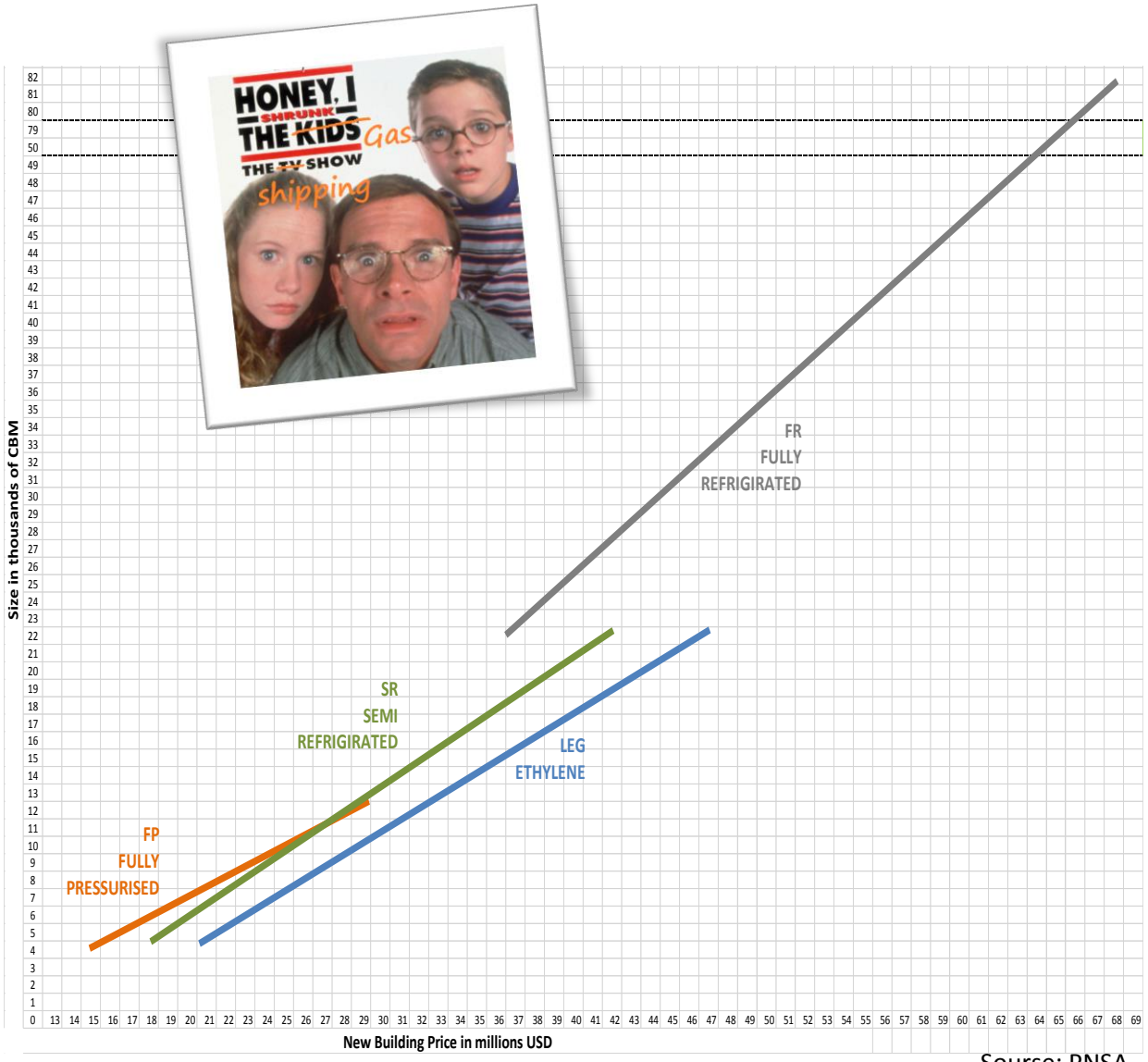
- **Ethylene Carriers (LEG)**

These are effectively SR ships, with an added 2nd stage cooling down to -104°C (which is required for Ethylene Carriage.

- **Fully Refrigerated (FR)**

Rely solely on refrigeration to reduce volume and typically cover the bigger sizes than ships utilizing pressure.

The trading patterns across the types of LPG ships are much more segregated than traditional shipping segments such as bulkers or tankers.

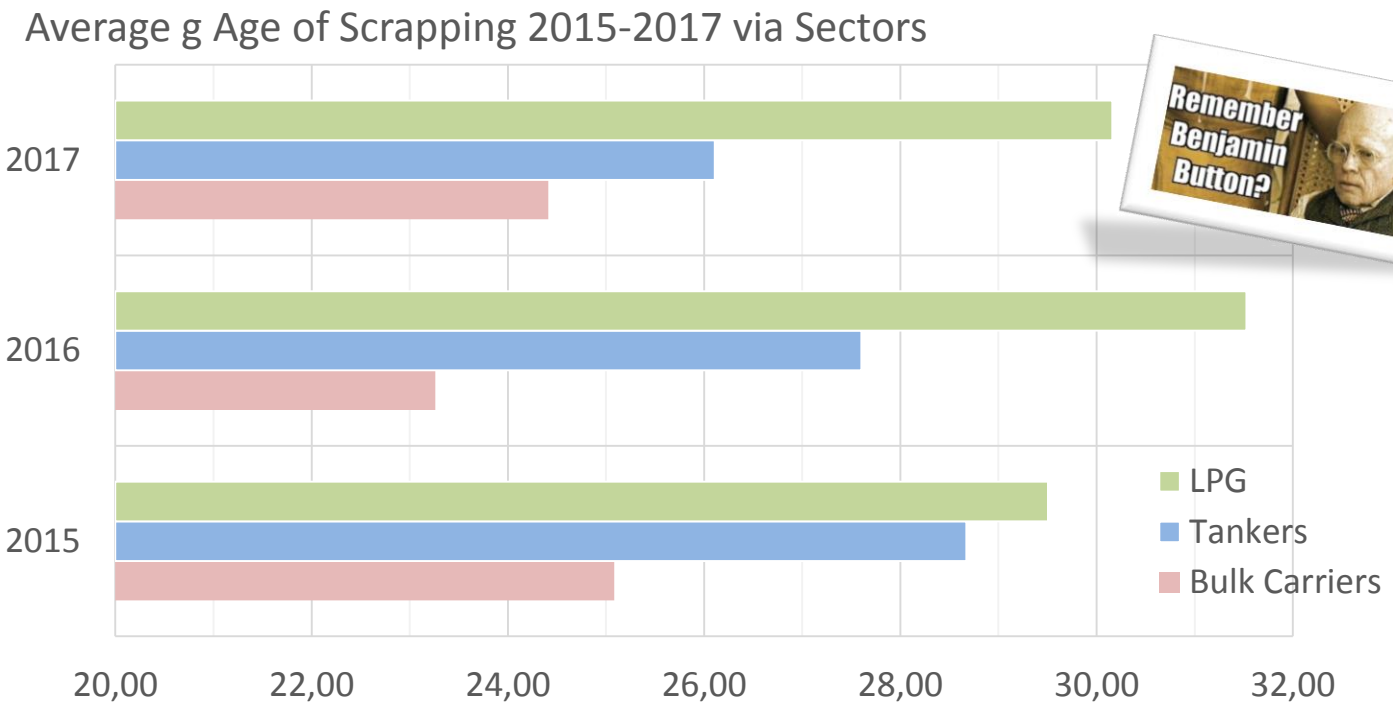


Sourse: PNSA

Few and various specialised types also exist and are omitted from this analysis such as LNG/LEG combination and Ethane carriers.

LPG Ships: Liquidity and Longevity

Ship Type	Bulkers	Tankers	LPG
Averge Number of Ships Sold per Year (1997-2017)	417	247	43
Number of Ships Sold per Year, as % of Respective Fleet (1997-2017)	4.9	4.8	3.3



Sourse: PNSA processing Clarksons raw data

Liquidity:

- There is truth in the assertion that LPG assets (ships) are illiquid, in relation to traditional sectors.
- That is more true in absolute numbers.
- Whereas in terms of percentage of fleet, the numbers show LPG comparing reasonably well.

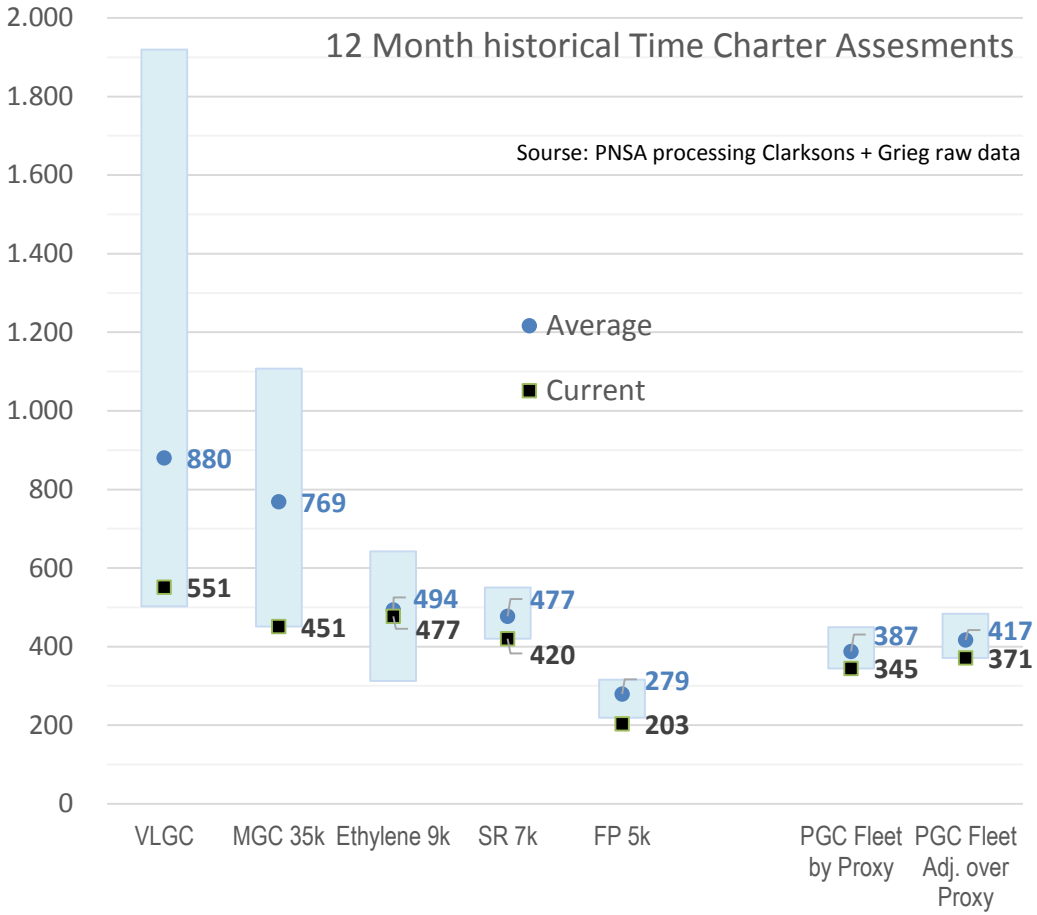
Longevity:

- LPG ships seem to consistently be able to trade for a longer life than ships in traditional sectors.
- This tendency appears immune even to bad earnings environment and oversupply situations, such as the last few years.
- Considering most public shipping companies use 30 year depreciation accounting policies, only LPG ships meet this. The same method in other sectors is too optimistic and may lead to erroneous book versus market company valuations.

Earnings Characteristics

- Volatility varies significantly across sectors. In general, the bigger ships, have bigger vol.
- The overall vol in LPG, even including VLGCs, is less than Bulkers or Tankers.
- Minimums have never really threatened opex levels.

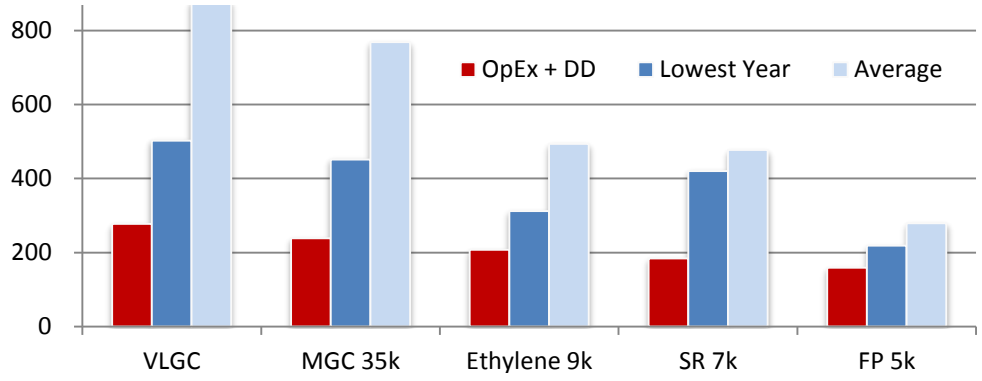
	VLGC	MGC 35k	Ethylene 9k	SR 7k	FP 5k		PGC LPG Fleet by Proxy	PGC LPG Fleet Adusted over Proxy
Lowest Year	502	451	312	420	219		345	**371**
Average	880	769	494	477	279		387	**417**
Current	551	451	477	420	203		345	**371**
Highest Year	1.919	1.108	643	550	316		449	**484**
1 St.Dev.	354	161	98	32	31		30	**32**
Volatility	40%	21%	20%	7%	11%		8%	**8%**



The PGC Fleet can be simulated/backtested by assigning appropriate weights (1 x 9k Ethy + 2 x 7k SR + 2 x 5k FP). And then adjusting for the difference of actual PGC earnings versus Clarksons TC assessments

- This allows us to get an idea of expected volatility, earnings levels but also correlation to other sectors.
- Knowing correlations, we can then see if we should worry or not from sectors with big orderbooks.

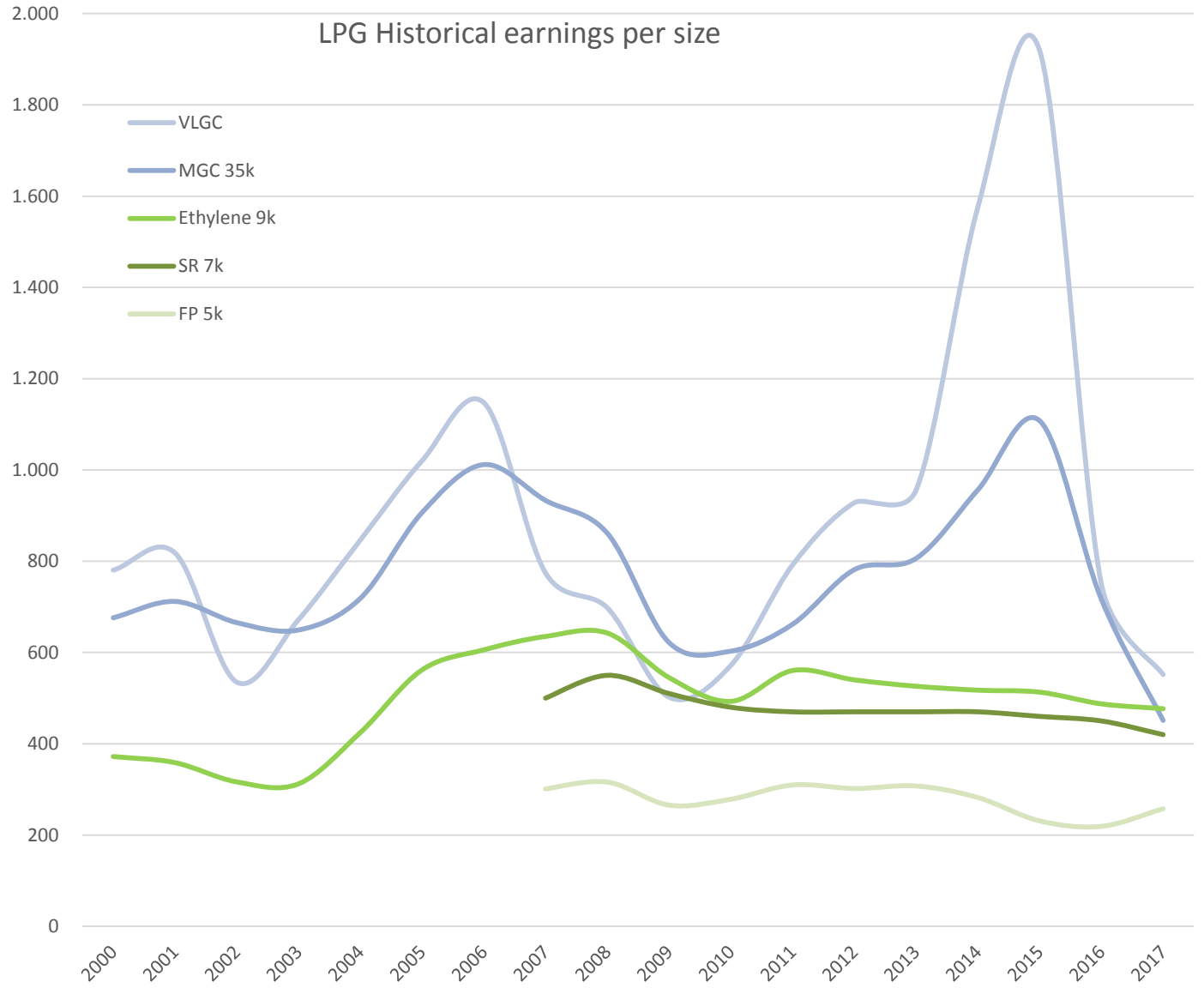
Which Fleet Segment Affects us?	VLGC	MGC 35k	Ethylene 9k	SR 7k	FP 5k
PGC LPG Fleet Correlations:	-22%	26%	93%	90%	81%
Orderbook % of Fleet (cbm basis):	15%	13%	5%		1%
			8%	Ethylene	



LPG Earnings History

Date	VLGC	MGC 35k	Ethylene 9k	SR 7k	FP 5k
2000	780	676	372		
2001	818	712	359		
2002	535	665	316		
2003	672	649	312		
2004	846	718	424		
2005	1.020	907	562		
2006	1.148	1.012	606		
2007	774	933	635	500	301
2008	698	861	643	550	316
2009	502	622	545	510	265
2010	572	603	493	480	279
2011	792	662	561	470	310
2012	928	782	540	470	302
2013	956	806	526	470	308
2014	1.576	956	517	470	282
2015	1.919	1.108	513	460	231
2016	750	717	487	450	219
2017	551	451	477	420	258
Source:	**Clarkson's**	**Clarkson's**	**Clarkson's**	**GRIEG**	**Clarkson's Derived**

All figures in $,000/Month



The LPG Fleet (or Supply)

Apart from monitoring fleet profile and development across sizes, as we do in traditional segments, we also have to consider the ship types. This is specially so in the smaller sizes where types overlap the most (as per previous slide).

All figures number of vessels

			Fleet/OB	Delivery year (#)				Breakdown exisiting fleet (#)						Breakdown order book (#)					
Type	Fleet	OB	ratio	2017	2018	2019	2020+	E	Pr	Sr	Fr	E/LNG	E/Ethane	E	Pr	Sr	Fr	E/LNG	E/Ethane
VLGC*	265	30	11%	9	5	13	3	-	-	-	259	-	6	-	-	-	30	-	-
LGC	24	0	0%	-	-	-	-	-	-	-	24	-	-	-	-	-	-	-	-
MGC**	123	11	9%	1	8	2	-	-	-	-	118	-	5	-	-	-	10	-	1
Handy***	91	12	13%	-	6	6	-	24	-	59	-	8	-	9	-	3	-	-	-
8K-15K cbm	132	6	5%	3	3	-	-	71	29	26	-	6	-	4	1	1	-	-	-
3.75K-7.99K cbm	257	9	4%	3	4	2	-	51	159	45	-	2	-	-	8	1	-	-	-
1K-3.75K cbm	253	2	1%	-	2	-	-	9	210	34	-	-	-	-	2	-	-	-	-

** incl VLEC, ** FR and ethane capable vessels only, *** excl FR vessels*

PGC Eirini TBD March 2018
Constituting 100% of the <10k SR orderbook

All figures in 1,000 cubic meters and type

			Fleet/OB	Delivery year (1,000 cbm)				Breakdown exisiting fleet (1,000 cbm)						Breakdown order book (1,000 cbm)					
Type	Existing	OB	ratio	2017	2018	2019	2020+	E	Pr	Sr	Fr	E/LNG	E/Ethane	E	Pr	Sr	Fr	E/LNG	E/Ethane
VLGC*	21,646	2,491	12%	751	407	1,085	248	-	-	-	21,132	-	515	-	-	-	2,491	-	-
LGC	1,424	-	0%	-	-	-	-	-	-	-	1,424	-	-	-	-	-	-	-	-
MGC**	4,102	417	10%	37	304	76	-	-	-	-	3,923	-	179	-	-	-	380	-	37
Handy***	1,870	250	13%	-	122	128	-	468	-	1,182	-	220	-	184	-	66	-	-	-
8K-15K cbm	1,317	74	6%	37	37	-	-	700	308	245	-	64	-	48	13	13	-	-	-
3.75K-7.99K cbm	1,442	55	4%	15	30	10	-	296	895	237	-	14	-	-	48	7	-	-	-
1K-3.75K cbm	801	7	1%	-	7	-	-	24	680	97	-	-	-	-	7	-	-	-	-

** incl VLEC, ** FR and ethane capable vessels only, *** excl FR vessels*

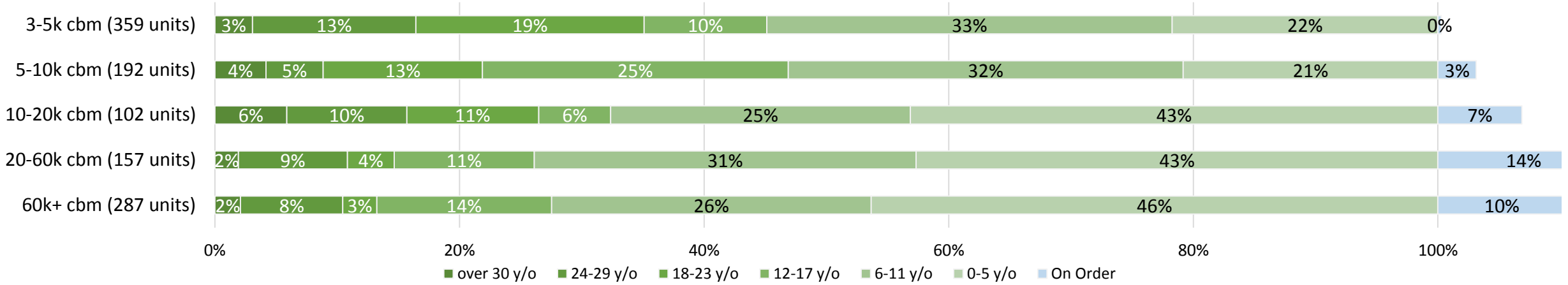
Source: Grieg Ship Brokers

- Supply side, which is normally simple to analyze, has the added complication of ship type; beyond size segmentation.
- Partly for same reason earnings are more uncorrelated in LPG. This allows focus on sub parts of the whole spectrum.
- If matrix approach is used (size x type), it maybe advisable to use ship # as opposed to capacity used in correlated markets (Bulkers & tankers).

LPG Fleet Size x Type

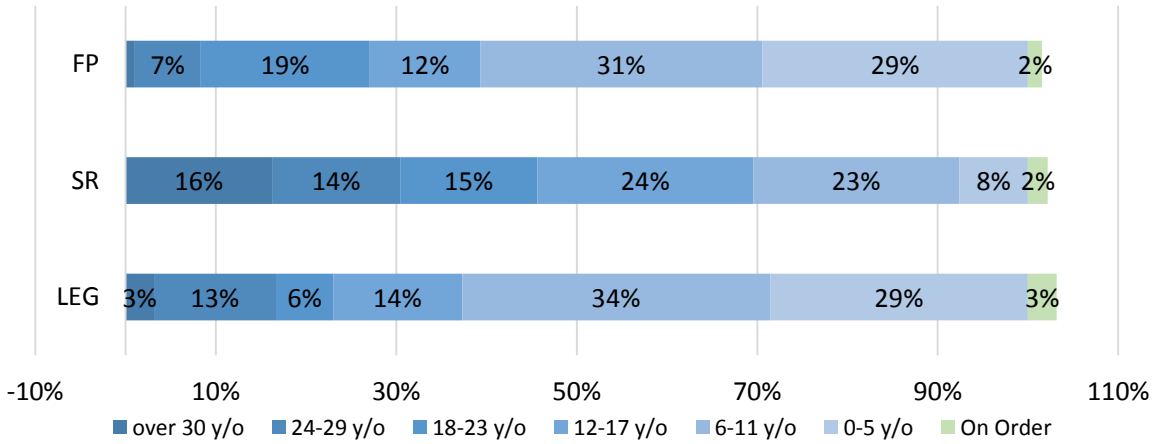
- Orderbook is very benign in small sizes
- In the bigger sizes it is significant, but not worse than in, say tankers.
- All sizes have already absorbed the worst part of the recent ordering spree
- The smaller spectrum of ships have a older fleet profile, with some 1/5 ships 20 yrs or older.

LPG Global Fleet Profile & Orderbook

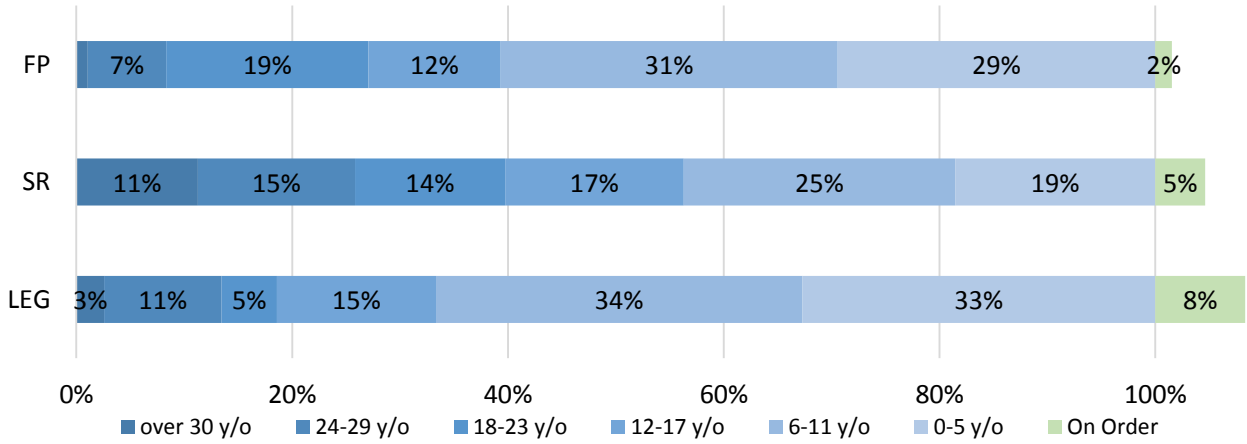


- When examining types in the smaller segments we note than only ethylene carriers have notable orderbook
- The FP and SR ships are getting really old with about 1/3 of them being 20 years old or more and a quarter 25 years or more!

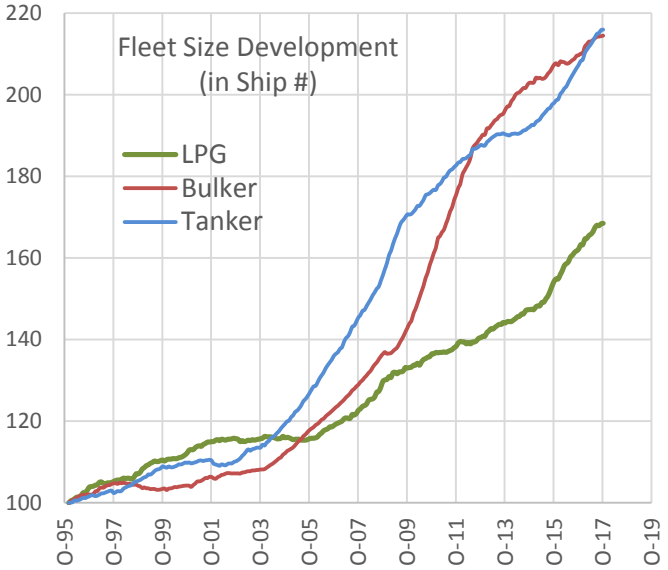
3-13k LPG Fleet Profile wrt Type and Age



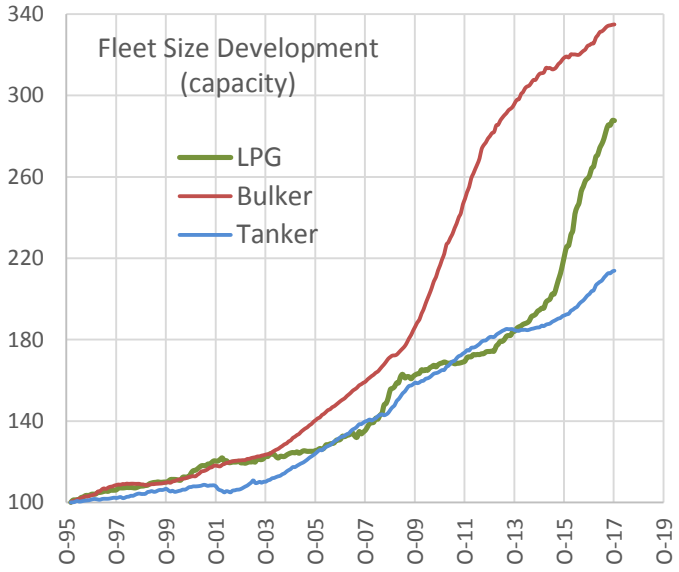
3-23k LPG Fleet Profile wrt Type and Age



LPG Fleet Evolution



Sourse: PNSA processing Clarksons raw data

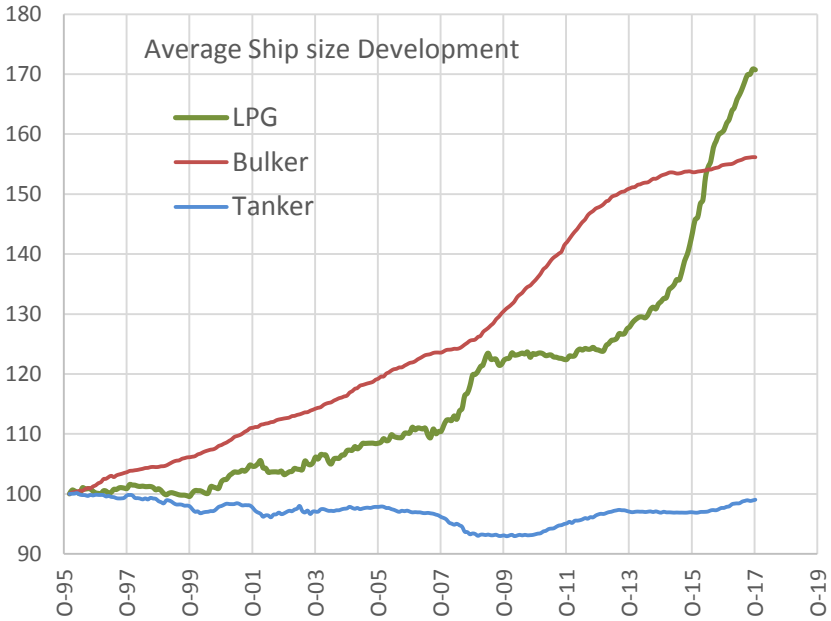


We compare with traditional other sectors, namely bulkers and tankers, to gainperspective to the development of the LPG fleet over the last 20 years or so. We also index January 1996 to 100, in order to have “apples to apples” visualization of the results.

- The LPG Fleet has risen only modestly in comparison, when considering number of ships in the water.
- In contrast it has risen significantly if capacity is considered (albeit less than bulkers).
- The first interesting observation in the capacity rise is that it appears to occur the last few years, as opposed to the hangover of the party years 05-08 as in Bulkers.
- The Average Ship Size has had a rather dramatic rise, clearly focused to recent years.

- LPG Average Size increase is unlike the case in bulkers where every size segment has increased within its respective class.
- LPG avg size increase in attributed to the addition of bigger ships to the fleet, mostly due to the new China import boom (PDH plants) as well as US Shale revolution – a trade suing VLGCs predominantly.
- What can not be evident in the scale of these graphs is that the pressurized sector has also grown benefiting from tech improvements in compression (biggest FP ship was abt max 5k cbm 20 years ago and now its 11k and tech for 12k is available

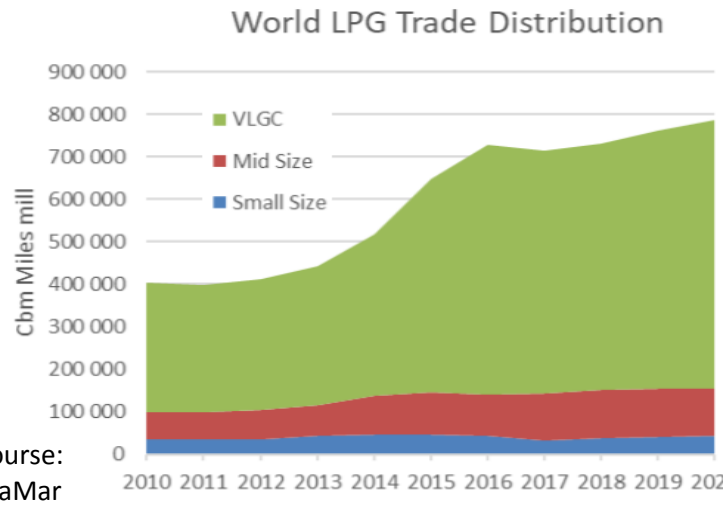
Sourse: PNSA processing Clarksons raw data



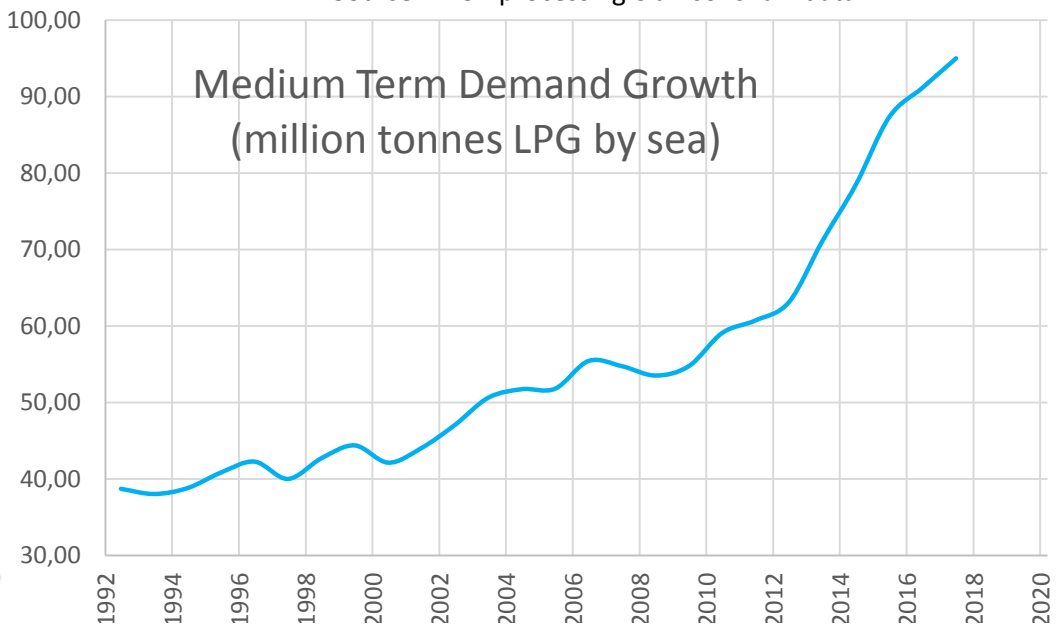
LPG Demand

- Long term demand (= tons of cargo moved by sea) was exhibiting a rather astonishing stability of growth until a few years ago.
- Then the impact of China/USA VLGC trade has completely distorted the previous 50 year trend.
- As unprecedented as this rise in demand has been, supply managed to not only catch up, but even upset the balance against the owners.
- Due to the rather specific causes in this demand hike, we are assuming a shift rather than a trend in the future years. i.e. we rather treat this as a one-off event.
- Once again, caution is advised to not take an overall approach on total volumes, but to try to focus closer to the sizes and types of ships one is considering.

Sourse: PNSA processing Clarksons raw data



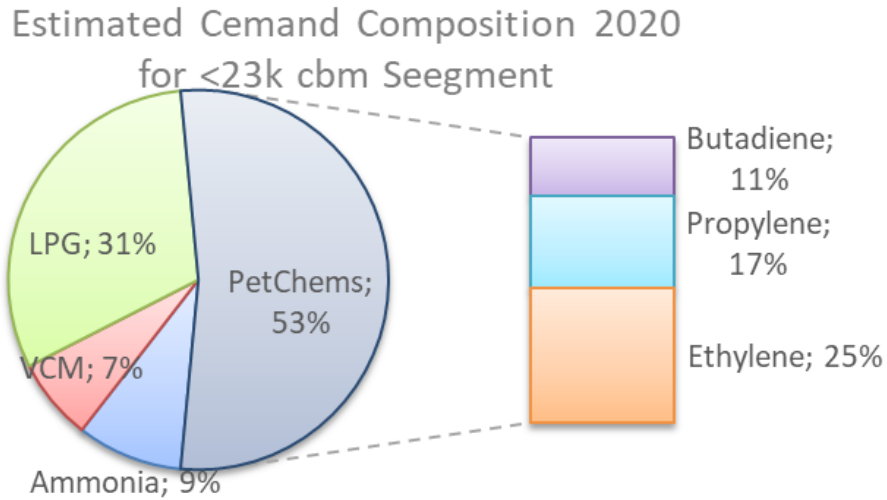
Sourse: ViaMar



LPG Demand <23k cbm

Cargo	Composition (2017)	Seaborne Trade by Cargo Type - Growth YoY cbm.miles								
		2012	2013	2014	2015	2016	**2017**	2018	2019	2020
Ammonia	9%	-4.4%	-4.9%	4.0%	-3.1%	-1.1%	**1.9%**	-5.9%	0.5%	1.0%
VCM	7%	-19.6%	6.2%	3.9%	-9.3%	-11.1%	**21.0%**	1.2%	13.0%	9.5%
LPG	31%	3.2%	22.0%	3.4%	0.6%	-4.5%	**-25.2%**	13.5%	7.6%	11.9%
Butadiene	11%	4.7%	-15.6%	-15.0%	-4.8%	26.6%	**4.6%**	-0.7%	8.7%	7.7%
Propylene	17%	13.0%	-4.2%	1.6%	14.3%	-6.2%	**8.8%**	8.5%	14.2%	14.0%
Ethylene	25%	-6.9%	-14.5%	-5.5%	1.3%	37.9%	**16.1%**	1.7%	4.7%	7.6%
Totals	100%	**-5.0%**	**2.8%**	**-0.8%**	**2.0%**	**4.4%**	**4.0%**	**6.3%**	**8.5%**	**9.9%**

- Demand analysis, is more complicated than in traditional sectors. Inter alia, more than half the volume transported is industrial high-end product.
- Petchem Gases seen firm growth this year. Outlook remains positive.
- Ammonia loosing steam and shows no prospects to reverse.
- MGC (35k cbm) tonnage oversupply, in combination with slow ammonia trade (hence ships focusing on LPG), creates competition (increases correlation across size segments) and hurts the small LPG.



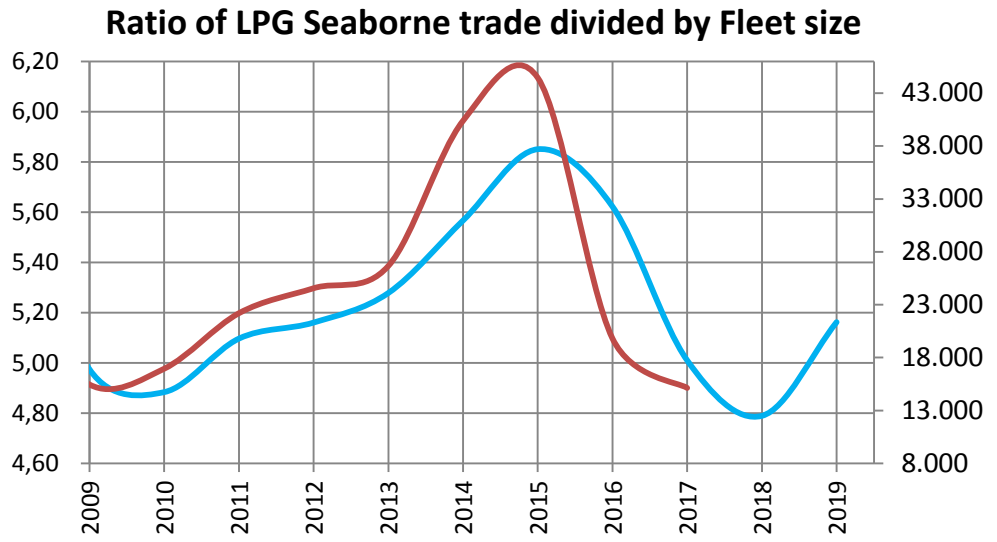
Sourse: ViaMar Data, PNSA Processed

Supply v. Demand

Attempting to look at the overall/total picture (which is ill-advised, we apply part of the methods used for tankers or bulkers. The most primitive is to watch the development of the ratio or cargo carried by sea (in tons) to Fleet size (in cbm x 0.6 assumed density, typical for LPG mix). [blue line is ration on L-axis, Red line is Clarksons historical LPG earnings on R-axis $/day]

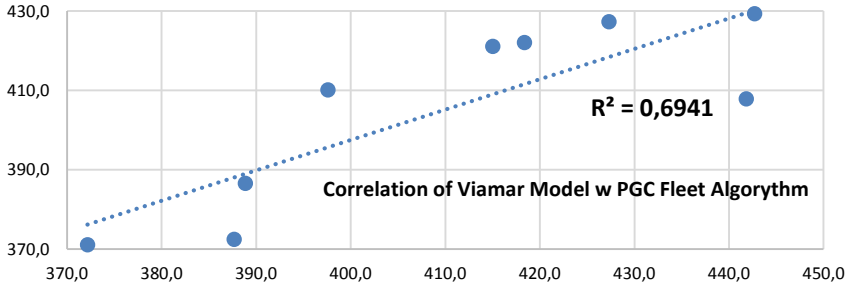
We also insert the projections from both ViaMar and Clarksons for the years 2018 and 2019.

- It would appear that the overall decline will reverse some time in 2018.
- It must be held in mind though, that this methodology is dominated by the bigger sizes effects, and better be used for those and not the smaller sizes with little historical earnings correlation to the big sizes.



Now, let's focus on **less than 23k cbm**:
Clarksons has no breakdown of demand beyond total, hence we must rely on Via Mar. But first we undertake a back test of ViaMars supply/demand results against the PGC Fleet algorithm of page 5.

The fit appears reasonably good. Especially if one is only looking for direction of earnings (as one should constrain oneself to) and not trying to predict actual levels. Hence, we can perhaps allow ourselves to share ViaMar's optimism:



ViaMar Data/Projections			Year
Supply	Demand	**Delta**	**2009**
5.7%	9.1%	**3.4%**	**2010**
6.0%	6.2%	**0.2%**	**2011**
5.0%	-0.5%	**-5.5%**	**2012**
3.6%	2.8%	**-0.8%**	**2013**
3.4%	-0.8%	**-4.2%**	**2014**
4.2%	2.0%	**-2.2%**	**2015**
4.7%	4.4%	**-0.3%**	**2016**
3.9%	-0.1%	**-4.0%**	**2017**
3.2%	6.3%	**3.1%**	**2018**
1.8%	8.5%	**6.7%**	**2019**
2.6%	9.9%	**7.3%**	**2020**