argusmedia.com

Argus Base Oils - Annual Review 2016

Petroleum
illuminating the markets

Market Reporting
Consulting
Events

argus

argusmedia.com

Argus *Base Oils - Annual Review*

Base oil market prices, news and analysis in 2016

PRICES AT A GLANCE

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

Asia-Pacific	Low	High	±
Group I			
SN 150 ex-tank Singapore	560.00	600.00	+45.00
SN 500 ex-tank Singapore	655.00	695.00	+70.00
Bright stock ex-tank Singapore	855.00	895.00	-115.00
SN 150 fob Asia	500.00	540.00	+65.00
SN 500 fob Asia	590.00	630.00	+110.00
Bright stock fob Asia	795.00	835.00	-90.00
Group II			
N150 ex-tank Singapore	565.00	605.00	+72.50
N500 ex-tank Singapore	740.00	780.00	+135.00
N150 fob Asia	515.00	555.00	+115.00
N500 fob Asia	680.00	720.00	+175.00

$/t

Northeast Asia	Low	High	±
Group I			
SN 150 cfr	505.00	545.00	+50.00
SN 500 cfr	645.00	685.00	+100.00
Bright stock cfr	845.00	885.00	-115.00
Group II			
N150 cfr	550.00	590.00	+120.00
N500 cfr	725.00	765.00	+180.00

$/t

India and UAE	Low	High	±
Group I			
SN 150 (LVI) cfr India	520.00	560.00	+90.00
SN 500 (LVI) cfr India	620.00	660.00	+177.50
Bright stock cfr India	745.00	785.00	-155.00
SN 150 (LVI) cfr UAE	540.00	580.00	+125.00
SN 500 (LVI) cfr UAE	610.00	650.00	+185.00
Group II			
N150 cfr India	560.00	600.00	+102.50
N500 cfr India	725.00	765.00	+155.00

$/t

Europe	Low	High	±
Group I			
SN 150 fob domestic NWE	600.00	640.00	+7.50
SN 500 fob domestic NWE	675.00	715.00	-42.50
Bright stock fob domestic NWE	815.00	850.00	-140.00
SN 150 fob European export	525.00	565.00	+22.50
SN 500 fob European export	590.00	630.00	-20.00
Bright stock fob European export	745.00	785.00	-150.00
Group II			
N150 fca ARA	615.00	655.00	-75.00
N600 fca ARA	770.00	810.00	-30.00
Group III			
4cst fca NWE	668.00	710.00	-198.00
6cst fca NWE	700.00	736.00	-182.50
8cst fca NWE	663.00	705.00	-200.00

$/t

Russia and FSU	Low	High	±
Group I			
SN 150 fob Baltic Sea	510.00	550.00	+80.00
SN 500 fob Baltic Sea	520.00	560.00	+15.00
SN 150 fob Black Sea	450.00	490.00	+0.00
SN 500 fob Black Sea	520.00	560.00	+60.00

$/t

US	Low	High	±
Group I			
SN 150 fob	470.00	518.00	+27.50
SN 500 fob	507.00	554.00	-181.50
Bright stock fob	653.00	700.00	-264.00
Group II			
N100 fob	474.00	524.00	+59.00
N220 fob	476.00	525.00	+58.00
N600 fob	684.00	732.00	-111.00
Group III (domestic)			
4cst	822.00	873.00	-9.50
6cst	819.00	869.00	-19.00
8cst	888.00	939.00	+25.00
Naphthenic base oils			
Pale oil 60 fob	504.00	551.00	+38.50
Pale oil 100 fob	495.00	542.00	+47.00
Pale oil 500 fob	483.00	529.00	+35.00
Pale oil 2000 fob	488.00	536.00	+27.00

$/t

OVERVIEW

Global base oil prices mostly rebounded in 2016, following a recovery in crude oil prices and firm demand in Asia-Pacific for Group II supplies. The rebound in Chinese demand in the first half of the year was especially strong. But bright stock prices fell, contrasting with firm prices in 2015, with the market under persistent pressure from oversupply. Group I heavy-grade prices were also lower in the US and Europe, despite the closure of two Group I plants in that market. Group III prices fell as the start-up of new production capacity increased competition in an already well-supplied market.

CONTENTS

ASIA-PACIFIC

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

Asia-Pacific base oil prices rose in 2016 on the back of a price surge in the first half of the year. But a drop in prices during the second half of the year trimmed the size of the increase.

Group II heavy-grade prices posted the largest rise, climbing from less than $500/t fob Asia in February to more than $740/t fob by early July. They then pared those gains during the second half of the year, easing to less than $670/t by end-November, before recovering in the last few weeks of the year.

Group I heavy-neutrals also rose strongly during the same period, from around $425/t in February to around $640/t fob in June. These prices also then dipped by some $80-90/t during the second half of the year before staging a recovery in December.

The price surge in the first half reflected the impact of a rebound in Chinese demand from late February. The revival in buying interest was unusually strong and fast, after many blenders had purposefully kept stocks low and held off replenishing inventories because of the sustained slide in crude prices during the second half of 2015 and January 2016.

Run cuts, maintenance curb supply

Refinery run cuts in China, the delayed start-up of new capacity in that market, and preparations for the nearly two-month shutdown of Taiwan's 600,000 t/yr Group II plant from June added to the tightness.

The subsequent sharp rise in prices opened the arbitrage to China. That incentivised producers to prioritise that market ahead of others such as India and southeast Asia. Supplies to those markets then tightened.

The pick-up in buying activity in China also coincided with tighter Group I supplies in southeast Asia, where annual demand typically peaks in markets like Thailand around March and April. The rise in domestic consumption at that time curbed availability of surplus supplies for export during those months. Unexpectedly strong demand during the following months sustained that tight availability.

Stockbuilding ahead of a scheduled Group I plant shutdown in Thailand in the third quarter of the year extended the tightness through the summer. The drop in supplies helped to counter the impact of a seasonal slowdown in demand during the summer months.

Group I supplies from Indonesia also tightened in the second quarter of the year as domestic blenders built stocks ahead of the fasting month of Ramadan, which began in early-June. Indonesia's Group I plant then also had a one-month shutdown from late July for scheduled maintenance. The shutdown similarly slowed any buildup of surplus supplies during the summer months.

Group I	Low	High	±
$/t			
SN 150 ex-tank Singapore	560.00	600.00	+45.00
SN 500 ex-tank Singapore	655.00	695.00	+70.00
Bright stock ex-tank Singapore	855.00	895.00	-115.00
SN 150 fob Asia	500.00	540.00	+65.00
SN 500 fob Asia	590.00	630.00	+110.00
Bright stock fob Asia	795.00	835.00	-90.00

Group II	Low	High	±
$/t			
N150 ex-tank Singapore	565.00	605.00	+72.50
N500 ex-tank Singapore	740.00	780.00	+135.00
N150 fob Asia	515.00	555.00	+115.00
N500 fob Asia	680.00	720.00	+175.00

Group III	Low	High	±
$/t			
4cst ex-tank Singapore	700.00	760.00	-127.50
6cst ex-tank Singapore	695.00	755.00	-127.50

Ex-tank Singapore reference prices				$/t
	Group I		Group II	
SN 150	SN 600	Bright stock	N150	N500
605.00	725.00	860.00	585.00	755.00

Asia SN 500 forward prices	Low	High	±
$/t			
Jan 2017	600.00	620.00	+110.00
Feb 2017	604.05	624.05	+106.15
Mar 2017	607.25	627.25	+102.00
1Q 2017	603.75	623.75	+106.05
2Q 2017	612.10	632.10	+93.85

The price shows the implied forward-curve base oil price required to maintain its existing profit margin relative to Ice gasoil futures. Refer to www.argusmedia.com for methodology

Asia SN 500 forward premium to gasoil	Midpoint	±
$/t		
Jan 2017	138.30	+15.40
Feb 2017	134.25	+19.25
Mar 2017	131.05	+23.45
1Q 2017	134.55	+19.40
2Q 2017	126.20	+31.55

The premium shows the implied forward-curve profitability of fob Asia SN 500 relative to Ice gasoil futures. Refer to www.argusmedia.com for methodology

ASIA-PACIFIC

Besides tight availability, Group I prices got a boost in the first half from stronger demand on the back of the surge in Group II prices. The premium of Group II heavy-grade prices over Group I increased to as much as $130/t in July, from less than $50/t at the start of the year. The wide price gap incentivised some buyers to switch to Group I base oils instead.

A repercussion of the price surge in the first half of the year was an open arbitrage from Europe and a steady flow of Group I heavy neutrals from that market to southeast Asia and China. Those shipments exacerbated the third-quarter supply build following the end of most Group I and Group II plant maintenance by September.

Demand slows in 3Q

The pick-up in regional supplies also coincided with weak Indian demand during the monsoon season from June to September. Chinese demand for heavy-grade base oils also faced a seasonal slowdown ahead of the winter months. Group I and Group II prices subsequently fell steadily throughout the third quarter of the year.

The premium of Group I and Group II heavy-grade base oils to light-grade prices also narrowed in the second half of the year. But the drop was more muted than during the same period in 2015. Group II heavy-grade prices held at more than $160/t to light grades in the fourth quarter of 2016, down from a premium as high as $200/t in mid-year. The price spread had fallen to less than $110/t at the end of 2015, although it also peaked that year at a lower level of around $170/t.

The relative price strength of heavy-neutrals reflected the impact of more plentiful Group II light-grade supplies in the region throughout the year.

With supplies more readily available, fob Asia Group II light-grade prices fell more steeply than heavy-grade prices in the first two months of the year, before bottoming at around $370-380/t fob. They then rose less strongly before peaking at around $565/t fob Asia in mid-year. Like heavy-grade supplies, light-grade base oil prices got a boost from an open arbitrage to China in the first half of the year.

Weak prices deter production

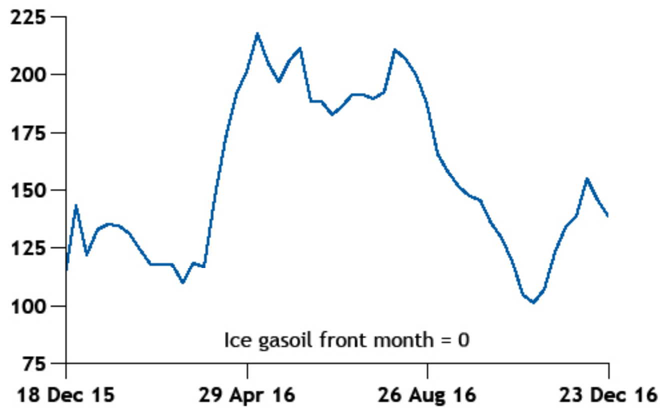
The rise in Group I light-grade prices was even more muted during the first half of the year. Prices peaked at around $490-500/t in mid-year, after bottoming at around $380-390/t in February. Their relative price weakness and steep discount to heavy-grade prices curbed the incentive for refiners to produce the product. The tighter availability helped to limit the price drop in the second-half of the year to just $20-30/t from its peak level.

Bright stock prices saw similar weakness in the first two months of the year as the other base oil grades. But its subsequent rebound in the second quarter of the year was more muted. Prices peaked in June at $960/t fob, up from around $860-870/t fob in February. The limited increase reflected persistent surplus volumes of the product, combined with unexpectedly slack Chinese demand. The relative price weakness contrasted with much stronger demand in 2015.

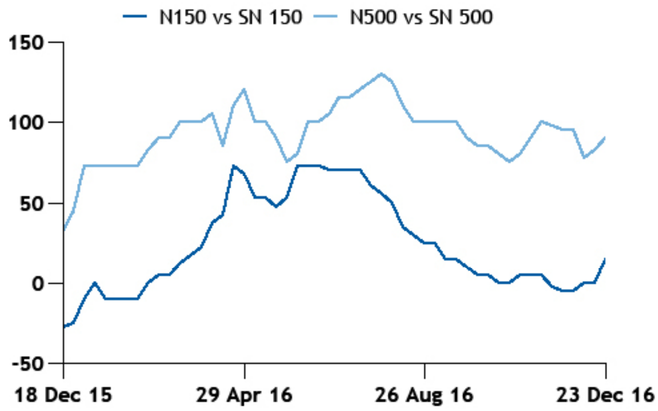
While seasonal demand had provided some price support ahead of the summer months, that support ebbed from the third quarter of the year. With surplus volumes increasingly plentiful from northeast and southeast Asia, bright stock prices then slumped from July much more steeply than any other base oil grade. They bottomed out at around $740-750/t fob in November before steadying. Their premium to SN 500 narrowed to less than $200/t by year-end, down from $450/t at the start of the year.

The smaller bright stock price-increase in the first half and price-slump in the second half of the year coincided with rebounding crude and gasoil prices. The bright stock premium to crude subsequently fell in the fourth quarter to less than $300/t, down from more than $600/t at the start of the year.

Asia SN 500 premium to Ice gasoil *$/t*



Fob Asia Group I vs Group II *$/t*



NORTHEAST ASIA

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

Northeast Asian base oil prices mostly rose in 2016. Group II heavy grades far outpaced the rise in Group I base oils and Group II light grades, while bright stock prices fell.

But the relatively small year-on-year price rise masked a volatile 12-month period. The gap between the lowest and highest prices was more than $150/t for Group II base oil prices and Group I heavy neutrals, more than $120/t for Group I light neutrals, and more than $200/t for bright stock.

Sliding crude and base oil prices in late 2015 laid the ground for the subsequent volatility. Falling base oil prices in late 2015, especially of heavy grades, spurred buyers in China to hold back to cover against exposure to even lower prices. The sustained slide in crude prices in January to their lowest levels in more than a decade added to a reluctance to buy.

Base oil prices subsequently extended their fall in the first two months of 2016.

But a recovery in crude prices from February coincided with moves by blenders throughout northeast and southeast Asia to replenish unusually low stocks. Chinese base oil imports had fallen in the fourth quarter of 2015 to their lowest level in two years, reflecting moves by Chinese buyers to keep stocks low.

Prices surge from late-February

The subsequent tightness and pick-up in demand triggered a surge in domestic Chinese base oil prices from late February, especially for Group II supplies. These rose to unusually steep premiums to imported cargo prices. The high premiums incentivised regional producers to prioritise shipments to the Chinese market.

But regional availability was limited by widespread stock replenishment in producers' own domestic markets. A key Group II producer in Taiwan was also beginning to build stocks ahead of a two-month plant shutdown from the second half of June. Its first move was to stop offering spot supplies. It later began to trim its term volumes.

With Chinese demand strong and the arbitrage open, imported cargo prices for Group II heavy grades subsequently surged in the second quarter of the year. After bottoming out at $550-560/t cfr in February, prices peaked around mid-year at $785-795/t cfr.

The price surge contrasted with steadier prices in the US and European markets during the first half of the year. The result was a rare opening of the arbitrage to move US Group II base oils to China, as well as Group I supplies from Europe to that market. More than 50,000t of Group II light- and heavy-grade supplies from the US was subsequently loaded in May bound for China. These cargoes arrived in June and July.

Group I	Low	High	± $/t
SN 150 cfr	505.00	545.00	+50.00
SN 500 cfr	645.00	685.00	+100.00
Bright stock cfr	845.00	885.00	-115.00

Group II	Low	High	± $/t
N150 cfr	550.00	590.00	+120.00
N500 cfr	725.00	765.00	+180.00

Group III	Low	High	± $/t
4cst cfr	645.00	685.00	-70.00
6cst cfr	645.00	685.00	-70.00
8cst cfr	640.00	680.00	+70.00

China domestic prices	Yn/t			$/t		
	Low	High	±	Low	High	±
Group I, SN 150						
Northeast						
Daqing	5,800.00	5,900.00	-300.00	835.00	849.00	-107.50
Dalian	5,750.00	5,950.00	-250.00	827.00	856.00	-100.00
North						
Yanshan	5,900.00	6,000.00	-100.00	849.00	863.00	-78.00
South						
Maoming	5,650.00	5,850.00	-300.00	813.00	842.00	-107.00
Group I, SN 400						
Northeast						
Fushun	6,400.00	6,500.00	+200.00	921.00	935.00	-37.00
Dalian	6,500.00	6,600.00	+350.00	935.00	950.00	-15.00
South						
Maoming	6,300.00	6,500.00	+400.00	907.00	935.00	-5.50
Group II, N150						
East						
Gaoqiao	6,150.00	6,350.00	+300.00	885.00	914.00	-19.50
South						
Huizhou	6,300.00	6,500.00	+550.00	907.00	935.00	+18.00

China import price calculator *	Yn/t			$/t		
	Low	High	±	Low	High	±
Group I (imported prices)						
SN 150	6,354.00	6,699.00	+708.50	914.00	964.00	+41.00
SN 500	7,561.00	7,906.00	+1,193.00	1,088.00	1,138.00	+103.00
Bright stock	9,285.00	9,629.00	-417.50	1,336.00	1,386.00	-163.50
Group II (imported prices)						
N150	6,742.00	7,087.00	+1,297.50	970.00	1,020.00	+128.00
N500	8,250.00	8,595.00	+1,882.00	1,187.00	1,237.00	+202.00

** inc. 6% customs duty, 17% VAT and 1,711.50 Yuan/t consumption tax.*

NORTHEAST ASIA

The arrival of the shipments coincided with the shutdown of Taiwan's Group II plant from the second half of June. Chinese imports from Taiwan subsequently slumped to less than 15,000 t/month between June and August. Imports from Taiwan are typically around 35,000-40,000 t/month.

But Chinese base oil demand had already peaked by the end of the second quarter. The gap between domestic Chinese prices and imported cargo prices had also narrowed substantially, dampening the attraction and feasibility of moving more supplies to China.

Rather, some Chinese distributors began to face growing difficulty securing buyers for this swathe of Group II supplies. At the same time, with demand facing a seasonal slowdown during the summer months, many blenders preferred to wait for the resumption of supplies from Taiwan.

The drop in demand, increasingly sufficient supply, and the prospect of a significant rise in availability from September triggered a sustained drop in imported cargo prices. Heavy-grade prices fell back to less than $700/t cfr by mid-September.

Taiwan supplies rebound after maintenance

Chinese base oil imports from Taiwan then rebounded from September to more than 50,000t, their highest level since the first quarter of the year. The surge in supplies extended into October, before easing in November because of weak margins and expectations of a year-end slowdown in demand. But demand held unexpectedly firm at year-end as Chinese buyers began replenishing stocks earlier than usual in preparation for the seasonal pick-up in demand in the first quarter of 2017.

Group I heavy-grade prices enjoyed a similar surge in the first half of the year. Strong Chinese demand coincided with unexpectedly tight supply in southeast Asia because of firm domestic consumption in Thailand and Indonesia. With demand strong and supplies tight, Group I SN 500 prices surged to $700/t cfr northeast Asia in June, up from less than $500/t cfr in February.

Prices then eased, pressured by a seasonal slowdown in Chinese demand in the third quarter of the year. Supplies also got a boost from the delivery of a steady flow of arbitrage shipments from northern Europe.

Bright stock prices on a cfr northeast Asia basis rose less strongly than other base oil grades in the first half of the year, and then fell more steeply in the second half of the year. The relative price weakness reflected plentiful availability in China both from domestic production as well as a raft of overseas suppliers such as Japan, southeast Asia and Europe.

The price weakness also contrasted with bright stock's price strength in 2015, when prices rose to unusually large premiums to SN 150 and SN 500. Prices at that time were supported by much tighter availability caused by widespread plant maintenance in northeast Asia, including China.

The high prices also incentivised blenders to minimise their consumption of bright stock. Some buyers also secured a larger volume of supplies in early 2016 to cover against a repeat of those high prices. That early stockbuilding limited price gains from the very start of the year.

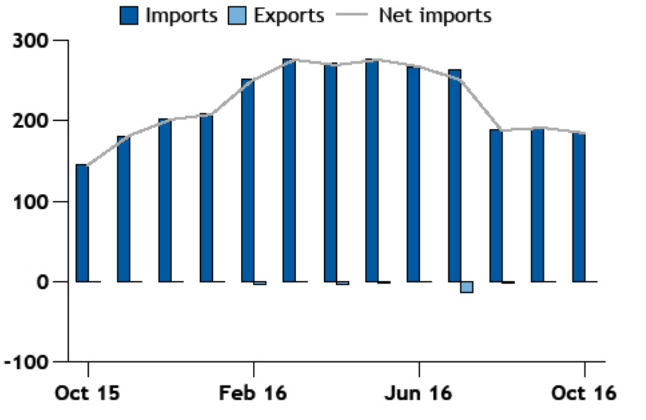
New capacity adds to supplies

Group II light-grade prices also rose strongly in the first half of the year on a cfr northeast Asia basis. But they maintained their steep discount of more than $100/t to heavy-grade prices. The wide price gap reflected China's structural shortage of heavy-grade supplies. It also reflected its increasingly plentiful availability of light grades following the start-up of more production capacity.

The new units included Sinopec's 400,000 t/yr Group II+/Group III unit at its Maoming plant in southern China, which began operations in June. Shandong Qingyuan's 600,000 t/yr Group II unit began operations at about the same time. But production from both units took several months to stabilise. CNOOC in October began a gradual start-up of a new 600,000 t/yr plant in Taizhou in eastern China.

The unit is designed to produce 400,000 t/yr of Group II+ and Group III base oils, and 200,000 t/yr of naphthenic base oils. The Chinese market is likely to reflect the impact of these new supplies next year once production stabilises.

Chinese base oil imports and exports *'000 t*



INDIA

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

India's Group II light-grade prices rose slightly in 2016. Prices rose strongly in the first half of the year, but most of the gains were then erased during the second half, before a late-year rebound. Heavy-grade prices rose much more strongly in the first half, then held onto most of those gains even as prices eased in the second half of the year.

Group I low-viscosity-index heavy-grade prices also surged in the first half, before easing slightly during the second half of the year. The gap between prices for on-specification base oils and low-viscosity-index base oils almost disappeared.

Group I on-specification light-grade prices held in a narrow range, supported by limited supplies and steady demand.

Base oil prices had already fallen sharply in late 2015, pressured by surplus supplies and weak demand for supplies from Asia-Pacific and Iran. These were sufficient to counter the limited volume of year-end Group II supplies from the US.

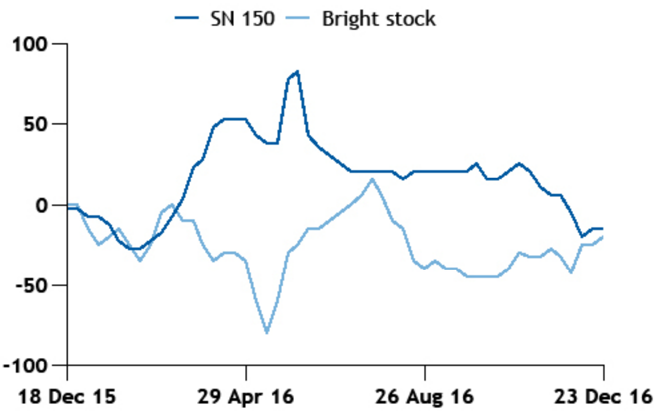
Prices extended their drop in the first two months of 2016. The availability of plentiful supplies was compounded by the sustained slide in crude prices until late January.

India's domestic producers were also offering at the start of the year large volumes of supplies, especially Group II heavy grades, at unusually competitive prices. Buyers subsequently covered a large portion of their requirements from these producers.

Chinese demand tightens supplies

The buying from domestic producers initially countered and masked the impact of moves by Asia-Pacific producers to prioritise exports to China, where prices and demand began to recover strongly from February. Blenders' plentiful stocks also countered tightening availability of spot volumes of light-grade base oils.

Indian base oils vs Europe *$/t*



** India midpoint price vs Europe high price*

Group I			$/t
	Low	High	±
SN 150 cfr	530.00	570.00	+17.50
SN 500 cfr	640.00	680.00	+77.50
SN 150 (LVI) cfr	520.00	560.00	+90.00
SN 500 (LVI) cfr	620.00	660.00	+177.50
Bright stock cfr	745.00	785.00	-155.00

Group II			$/t
	Low	High	±
N150 cfr	560.00	600.00	+102.50
N500 cfr	725.00	765.00	+155.00

Group III			$/t
	Low	High	±
4cst cfr	595.00	635.00	-40.00
6cst cfr	600.00	640.00	-45.00
8cst cfr	605.00	645.00	-5.00

Domestic refinery prices				
	*Rs/l **	±	*$/t*	±
Group I				
IOC prices, Chennai				
SN 70	59.15	+1.90	1,069.00	+7.00
SN 150	55.25	+1.90	938.00	+8.00
SN 500	61.65	+4.70	1,030.00	+54.00
Bright stock	80.50	-8.00	1,317.00	-169.00
IOC prices, Mumbai				
SN 70	57.15	+1.90	1,033.00	+8.00
SN 150	53.25	+1.90	904.00	+9.00
SN 500	57.15	+4.70	955.00	+56.00
Bright stock	78.95	-8.00	1,292.00	-168.00
Group II				
IOC prices, Chennai				
N70	66.19	+2.70	1,166.00	+18.00
N150	56.05	+1.90	973.00	+8.00
N500	62.41	+4.70	1,070.00	+55.00
IOC prices, Mumbai				
N70	61.45	+1.90	1,083.00	+7.00
N150	54.05	+1.90	939.00	+10.00
N500	58.35	+4.70	1,001.00	+57.00

** prices in Rs/l effective from 01 Dec*

INDIA

But subsequent opportunities to replenish stocks were more limited. There had been a dearth of year-end arbitrage shipments from the US. The shutdown of a Group III plant in Spain in the first quarter of the year curbed light-grade supplies from that market. The expected start-up of a new Group III plant in the UAE at the start of the year also failed to materialise. The plant subsequently started up in April, with initial shipments only from June.

Besides strong Chinese demand, supplies in Asia-Pacific also tightened as a Group II producer in Taiwan cut back exports ahead of a two-month plant-shutdown in June. The region's Group II producers subsequently continued to focus on maximising shipments to China, where prices had surged. Their spot and term availability for Indian buyers dwindled.

Producers raise prices in 2Q 2016

With supplies tight, demand firm and crude prices rebounding, the producers raised sharply their prices in the second quarter of the year. Tighter availability of term supplies also forced more buyers to secure more spot supplies, which were offered at even higher prices than contract volumes.

India's Group II light-grade prices subsequently rebounded to around $590-600/t cfr by late-June, after bottoming in February at levels as low as $420-430/t cfr. Heavy-grade prices rose even more sharply, to levels as high as $800/t cfr, up from around $520-530/t cfr in February.

But by mid-year, the market fundamentals began to change. The price surge had far outpaced much smaller price gains in the US, prompting that arbitrage to open. At least one shipment of Group II light- and heavy-grade base oils was subsequently fixed to move to India.

India's upcoming monsoon season from June was also spurring buyers to hold off committing to prices that they deemed to be too high.

Indian buyers secure Adnoc supplies

The start-up of state-owned Adnoc's new 600,000 t/yr Group III plant in the UAE also added a new, large, and conveniently-located source of supplies to the market. The new plant began operations in April, with initial supplies offered in May. Most of these were bought by Indian buyers. These were shipped in June and reached India shortly afterwards. The pattern repeated itself the following month. Imports of such light-grade supplies from the UAE subsequently surged in the three months to August to some 45,000t.

The sudden surge in imports of these new supplies left Indian buyers struggling with the logistical challenge of absorbing such volumes. A seasonal slowdown in finished lube demand during the monsoon season exacerbated the impact of the overhang. Buyers subsequently requested that producers in Asia-Pacific and Europe delay their August shipments for a month.

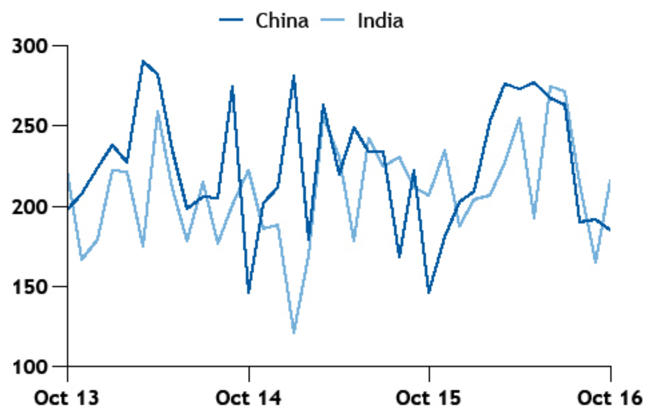
The competitive prices and high quality of these supplies forced a reaction from producers in South Korea. That country's exports to India surged this year, reflecting its key role as an outlet for the northeast Asian country's growing production capacity.

Producers slash light-grade prices in 3Q 2016

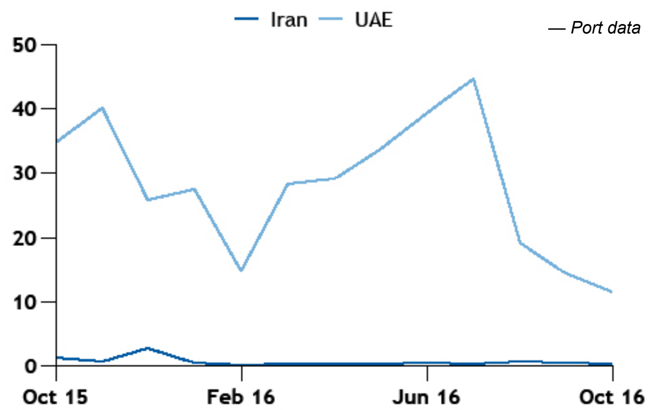
The South Korean producers responded by slashing price offers for their own-light grade base oils to levels that were lower than prices for supplies from the UAE. Prices slipped as low as $500-510/t cfr by the end of the third quarter.

The slowdown in Indian base oil imports during the third quarter was followed by a pick-up in demand from October as buyers looked to replenish stocks ahead of the peak-demand season from November. While availability remained plentiful, prices got support from firmer crude prices in the fourth quarter, refiners' weak margins and a

Chinese / Indian base oil imports *'000 t*



Indian imports from Iran and UAE *'000 t*



INDIA

dearth of arbitrage supplies from the US. Light-grade prices subsequently posted a mild recovery in the fourth quarter of the year, ending at more than $550/t cfr.

Heavy-grade prices fall more slowly in 3Q 2016

Group II heavy-grade prices avoided the impact of the new supplies from the UAE from mid-year. But they were impacted by the slowdown in Chinese demand for heavy grades from the third quarter. Supply tightness eased further following the restart of Taiwan's Group II plant from late August. Prices subsequently eased to less than $700/t by the end of the third quarter.

Spot supplies then tightened in the fourth quarter of the year on the back of plant maintenance in South Korea, as well as in India. Combined with firmer demand, prices edged back up to $700-750/t by year-end.

The high prices for Group II heavy grades throughout most of the year sustained firm demand for Group I base oils, especially for on-specification supplies. Availability of such supplies increased from both Saudi Arabia and Europe. Price offers at steep discounts to Group II supplies, and at competitive levels versus Group I supplies from Iran, sustained firm interest in these on-specification base oils.

Besides competition from on-specification supplies, less generous payment terms curbed buying interest for Iranian base oils. The slowdown contrasted with a surge in imports of the product in the second half of 2015, when demand was boosted by low prices and more attractive credit terms. Indian base oil imports from Iran fell to 154,000t in the first half of 2016, down from 197,000t during second-half 2015.

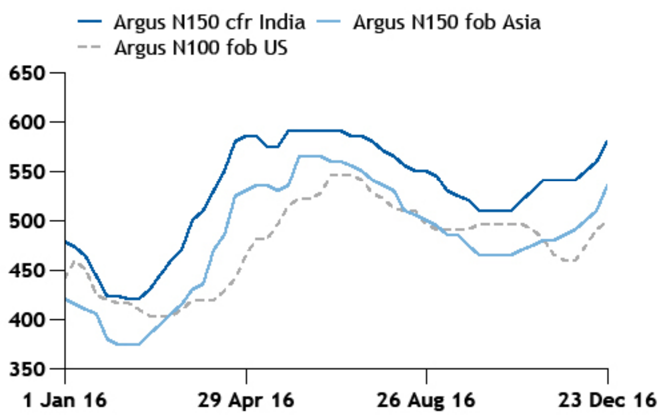
A sharp jump in price offers of Iranian base oils in late May and June dampened further any buying interest in these supplies. The higher price levels left the supplies at similar levels to on-specification SN 500 prices. The higher prices also left wide open the arbitrage to import Russian base oil supplies from the Black Sea market. Such arbitrage openings previously spurred a surge in such shipments. But the dearth of supplies from Russia continued, even with such large price-incentives.

Bright stock prices extend slide

Bright stock prices remained at low levels throughout the year, as buyers absorbed a steady flow of spot volumes from markets such as Europe, Brazil and the US. Prices began the year at around $900/t, before dipping some $50-60/t and then recovering to similar levels by mid-year. They then slid sharply in the third and fourth quarters of the year, with deals done regularly at less than $800/t cfr.

Group III base oil prices fell in 2016, although they remained in a narrow range. The impact of the surge in Group III supplies from the Mideast Gulf had a larger impact on the market for Group II light grades than for Group III. With these new supplies yet to secure approvals from major lube consumers such as automobile manufacturers, they had less room to displace supplies with such approvals. Even so, the price gap between approved and non-approved base oils narrowed, with buyers incentivised to use the lower-priced supplies as much as possible.

Global Group II base oil prices *$/t*



MIDEAST GULF

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

Mideast Gulf base oil prices rose in 2016, correcting higher after slumping steadily throughout the second half of 2015.

Iranian heavy-grade base oil prices edged gradually higher in the first quarter of the year, before surging in the second quarter. Prices then remained in a narrow range close to that level for the rest of the year.

The removal of sanctions on Iran at the start of the year raised some expectations of a rise in demand for the country's base oils. Producers in the country were keen to expand their number of outlets and curb an over-reliance on the regional market, especially India.

But any such rise in demand from other markets was tepid. Rather, buyers preferred to hold back as they focused on the sustained slide in crude prices at the start of the year. Plentiful availability of Iranian supplies in India, as well as a rise in domestic Group II heavy-grade supplies in that market, also curbed demand from that key outlet.

The sustained drop in Iranian base oil prices in the second half of 2015 had also left some buyers nursing large losses as they struggled to sell supplies bought earlier at higher prices. Some of them subsequently stopped dealing with Iranian base oils. Many other companies cut back or withdrew their credit terms and sought cash payment only. Others halted dealing with base oils or closed down.

Liquidity drops, sellers seek cash-payment

The effect was a drop in market liquidity and a move among producers in other markets such as Asia-Pacific to deal with larger buyers only. There was also a pick-up in activity in the ex-tank market. Payment was in cash. But buyers were better able to make such payments because they were securing smaller volumes.

Besides cautious buying activity and slower demand, Iranian sellers were also wary of opening the arbitrage for Russian supplies to move from the Black Sea market to the Mideast Gulf region.

Iranian base oil prices subsequently rose at a much slower pace in the first four months of the year than the rebound in crude prices. They also rose more slowly than surging Group II heavy-grade prices in Asia-Pacific and India. The gap between Group II heavy-grade and Group I Iranian heavy-grade prices in India widened to more than $230/t by May. It had narrowed to less than $100/t at the start of the year.

Prices surge from late May

But outright prices then surged by more than $100/t in late May and June. The rebound came after prices had held at unusually low levels relative to feedstock prices for the previous nine months. Prices had last held at such levels for four months to early 2013, before they also then rebounded.

Demand also firmed in the second quarter of 2016 as buyers replenished stocks ahead of the fasting month of Ramadan, which began in early June. Confidence that prices were unlikely to fall added to buying interest.

Prices then steadied at around $580-600/t fob Iran from July. Any further gains were constrained by slower demand.

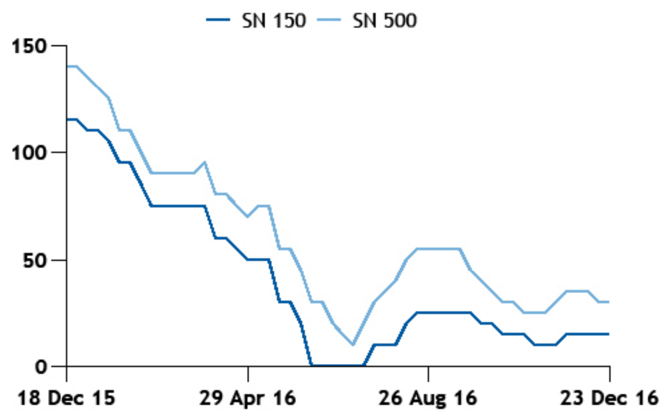
Group I			$/t
	Low	High	±
SN 150 cfr UAE	555.00	595.00	+30.00
SN 500 cfr UAE	640.00	680.00	+80.00
SN 150 (LVI) cfr UAE	540.00	580.00	+125.00
SN 500 (LVI) cfr UAE	610.00	650.00	+185.00

Group III			$/t
	Low	High	±
4cst ex-tank UAE	725.00	760.00	-65.00
6cst ex-tank UAE	735.00	765.00	-65.00
8cst ex-tank UAE	735.00	770.00	-65.00

Iran export prices		$/t
Sepahan Oil *		±
SN 500+ fob (bulk)	690.00	+0.00
SN 500 fob (bulk)	620.00	+0.00
Rubber process oil fob (drum)	380.00	+0.00
Slack wax fob (drum)	660.00	+0.00

** base oil prices on a fob Bushehr basis; RPO/slack wax prices on a fob Bandar Abbas basis, effective from 16 - 22 December*

SN 150/SN 500 vs (LVI) SN 150/SN 500 *$/t*



MIDEAST GULF

Alternative supplies cap price surge

Indian buyers received a regular flow of supplies of on-specification SN 500 at prices similar to or lower than Iranian base oils. A pick-up in availability of Group II heavy grades at increasingly lower prices also boosted demand for that product.

Buyers in the UAE market also received offers of Russian supplies from the Black Sea market at less than $600/t cfr. When availability from the Black Sea market thinned, buyers secured supplies at similar price levels from the Baltic market.

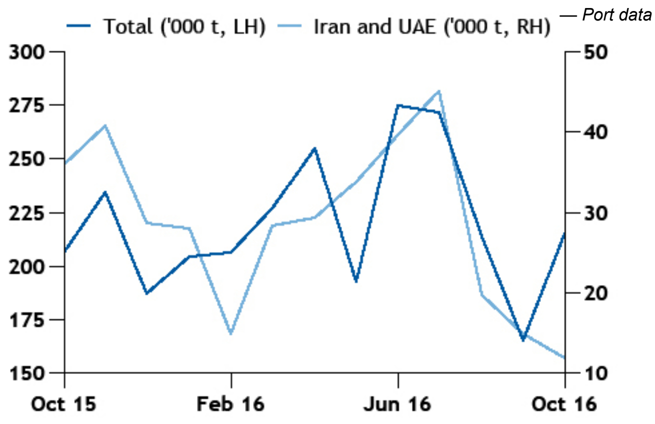
But even availability from that market tightened in the fourth quarter of the year. At the same time, a prolonged round of plant maintenance involving several base oil plants in the Mideast Gulf from August to November helped to counter the impact of slower demand, supporting steady price levels.

Maintenance ends, but arb from Europe stays shut

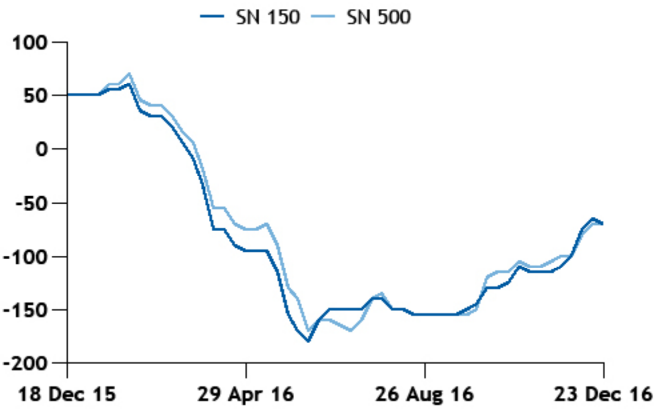
The end of that maintenance work in the fourth quarter eased any such tightness. The shipment of arbitrage Group I supplies to the region from markets such as US and Asia-Pacific added to regional supplies. But the lack of a year-end fire-sale of supplies from Europe or Russia curbed any price pressure during the last few months of the year. Rebounding crude prices added further price support.

Group III base oil prices held in a narrow range throughout most of the year. Prices for approved base oils especially held in a $800-850/t ex-tank UAE range, before easing in the fourth quarter. Prices had mostly also ignored the drop in crude prices in late 2015 and early 2016. They then ignored the recovery in Group I and Group II prices in the first half of 2016. They also ignored the impact of a surge in regional availability following the start-up of state-owned Adnoc's 620,000 t/yr Group III plant in April. But most of these supplies were shipped to other markets such as the US, India and Europe. Prices then eased at the end of the year amid increasingly plentiful availability.

Indian base oil imports *'000 t*



Black Sea vs UAE (LVI) *$/t*



** Black Sea high price vs UAE midpoint price*

EUROPE

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

European base oil prices weakened in the first quarter of 2016 despite the closure of two base oil units in the Netherlands.

Kuwait Petroleum Europoort shut its 235,000 t/yr base oils unit in January, while Shell Pernis phased out base oils production at its 370,000 t/yr plant in the first half of 2016.

The drop in heavy-grade base oils was especially steep. Domestic European prices dipped by $115/t in the first three months of the year to around $615-620/t. Bright stock prices had slumped to around $890/t by mid-March, down from around $970/t at the start of January.

The unexpected weakness, at a time when prices typically start to firm, reflected the impact of forward buying at the end of 2015. The move was spurred by the looming plant closures, as buyers and trading firms built up stocks to cover against any possible supply tightness. The stronger than usual demand in the last few months of 2015 then had the knock-on effect of softer than usual demand for spot supplies in the first months of 2016.

Firm demand and expectations of tight supplies prompted several plants to increase their run rates as they looked to increase their market share following the plant shutdowns. Unusually strong base oil values relative to feedstock and competing fuel prices added to producers' incentive to boost output.

Group I			$/t
	Low	High	±
SN 150 fob domestic NWE	600.00	640.00	+7.50
SN 500 fob domestic NWE	675.00	715.00	-42.50
Bright stock fob domestic NWE	815.00	850.00	-140.00
SN 150 fob European export	525.00	565.00	+22.50
SN 500 fob European export	590.00	630.00	-20.00
Bright stock fob European export	745.00	785.00	-150.00

Group II	€/t			$/t		
	Low	High	±	Low	High	±
N100 fca ARA	584.00	623.00	na	610.00	650.00	na
N150 fca ARA	589.00	627.00	-44.50	615.00	655.00	-75.00
N220 fca ARA	603.00	642.00	na	630.00	670.00	na
N600 fca ARA	737.00	776.00	+3.00	770.00	810.00	-30.00

Group III	€/t			$/t		
	Low	High	±	Low	High	±
4cst fca NWE	640.00	680.00	-155.00	668.00	710.00	-198.00
6cst fca NWE	670.00	705.00	-140.00	700.00	736.00	-182.50
8cst fca NWE	635.00	675.00	-157.50	663.00	705.00	-200.00

Turkey Group I			$/t
	Low	High	±
SN 150 cfr Gebze	510.00	550.00	-10.00
SN 500 cfr Gebze	585.00	620.00	+12.50

Arbitrage from Baltic opens

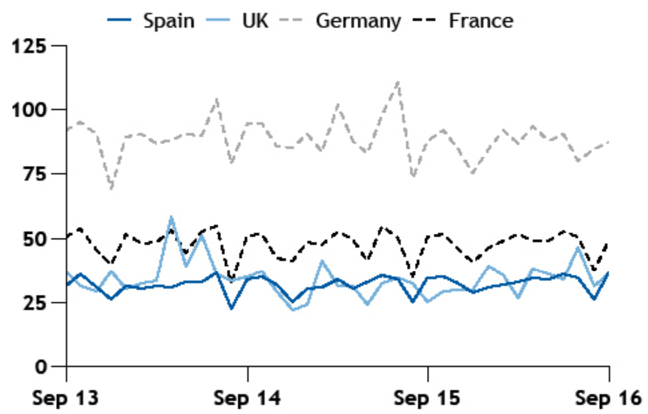
Higher European prices also opened the arbitrage from the Baltic market, spurring an unusually large wave of shipments from this market. Group II arbitrage supplies from Asia-Pacific added further to the region's supplies.

With producers raising output, arbitrage imports adding to stocks and demand then easing in the first quarter of the year, the market began to face a growing surplus.

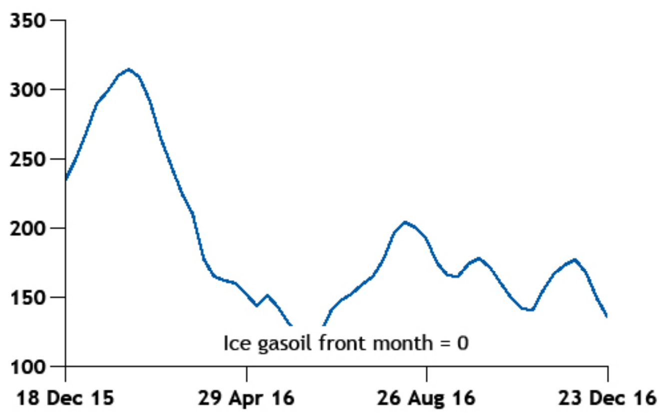
The oversupply of bright stock especially spurred the start of an extended fall in prices of the product in the export market from April. The weakness contrasted with steadier to firmer export prices for light- and heavy-grade base oils. Export prices for bright stock fell by $145/t from the start of the year to end at around $765/t in December.

Even with the price weakness, European prices for bright stock remained firm compared with other markets.

European lubricating oils demand *'000 t*



European SN 500 premium to Ice gasoil *$/t*



EUROPE

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

This limited arbitrage opportunities throughout the year and attracted competing supplies from markets like the US to target traditional markets like Africa and India.Relatively firm bright stock values relative to feedstock values also provided little incentive for producers to cut back output.

The bright stock supply overhang was eased by a 50-day planned turnaround at Eni's 84,000 b/d Livorno refinery in Italy that started at the end of September. The scheduled maintenance of a base oils unit at a north European plant in November also curbed supplies. But the market continued to face lingering surplus supplies of bright stock at the end of the year.

Prices of light-grade base oils firmed from April, supported by a seasonal pick-up in demand. Prices then held firm until the end of the year, with the product facing unexpectedly tight availability in the last quarter of the year. Domestic light-grade prices firmed to $620/t by the end of December, up from around $500/t in March.

But while outright prices were firm, they were unusually weak relative to feedstock and competing fuels. The weakness prompted producers to curb output of the product. The drop in supplies exacerbated the impact of the base oil plant closures in first-half 2016.

While supplies were tighter, a slower than expected uptake of Group II base oils by European blenders spurred stronger than expected demand. Blenders' reluctance to switch partly reflected the much higher cost of Group II supplies. But the premium of Group II light grades over Group I prices narrowed substantially to $15/t by the end of the year, from $202.50/t at its widest point in early March.

Intense competition in the Group III market led to price losses throughout the year. Prices for unapproved base oils especially faced pressure from persistent oversupply. The rise in supplies reflected the delayed start-up of Abu Dhabi's state-owned Adnoc's 620,000 t/yr plant in the second quarter of the year. Supplies from the plant began to move to Europe in the third quarter.

Supplies got a further boost from a steady flow of Russian shipments from Tatneft's 186,000 t/yr Group II/III plant in Nizhnekamsk. The surge in new supplies kept sustained pressure on prices. Group III prices fell to €660/t by the end of the year, down some €155/t from the start of the year. The spread between light-grade Group I and Group III prices narrowed dramatically from $277/t in January to $69/t by the end of the year. The narrow spread reflected the unexpected strength of Group I and the weakness of Group III.

European forward premium to gasoil $/t

	SN 150		SN 500	
	Midpoint	±	Midpoint	±
Jan 2017	73.30	-72.10	138.30	-114.60
Feb 2017	69.25	-68.25	134.25	-110.75
Mar 2017	66.05	-64.05	131.05	-106.55
1Q 2017	69.55	-68.10	134.55	-110.60
2Q 2017	61.20	-55.95	126.20	-98.45

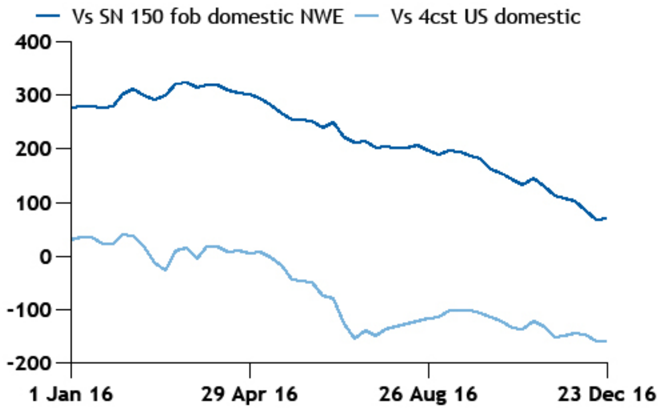
The premium shows the implied forward-curve profitability of fob Europe SN 150 and SN 500 relative to Ice gasoil futures.
Refer to www.argusmedia.com for methodology

European forward prices $/t

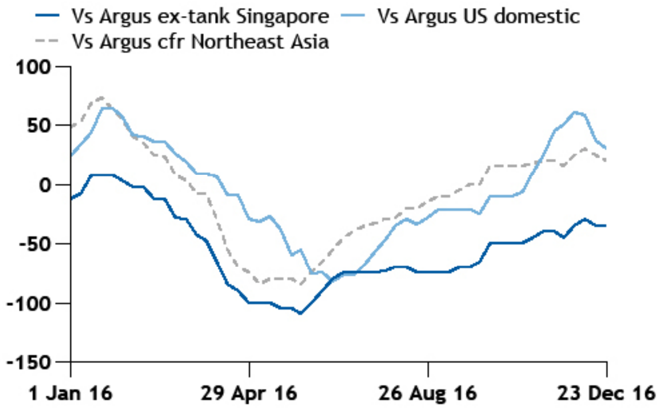
	SN 150			SN 500		
	Low	High	+/-	Low	High	±
Jan 2017	535.00	555.00	+22.50	600.00	620.00	-20.00
Feb 2017	539.05	559.05	+18.65	604.05	624.05	-23.85
Mar 2017	542.25	562.25	+14.50	607.25	627.25	-28.00
1Q 2017	538.75	558.75	+18.55	603.75	623.75	-23.95
2Q 2017	547.10	567.10	+6.35	612.10	632.10	-36.15

The price shows the implied forward-curve base oil price required to maintain its existing profit margin relative to Ice gasoil futures.
Refer to www.argusmedia.com for methodology

European 4cst vs SN 150, vs US 4cst $/t



Arbitrage opportunities - SN 150 fob European export $/t



RUSSIA AND FSU

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

Light-grade base oil prices rose in the Baltic Sea market in 2016, while heavy-grades mostly held in a narrow range. Light-grade and heavy-grade base oil prices fell in the Black Sea market, before recovering in the fourth quarter to levels close to the start of the year.

Prices for SN 150 on a fob Baltic basis began the year at around $445/t, before falling in February and March to around $400/t. They rebounded to $460/t in mid-year, before sliding back to around $400/t in August. Prices then began a recovery that gathered pace in the fourth quarter, with SN 150 climbing above $510/t fob in December.

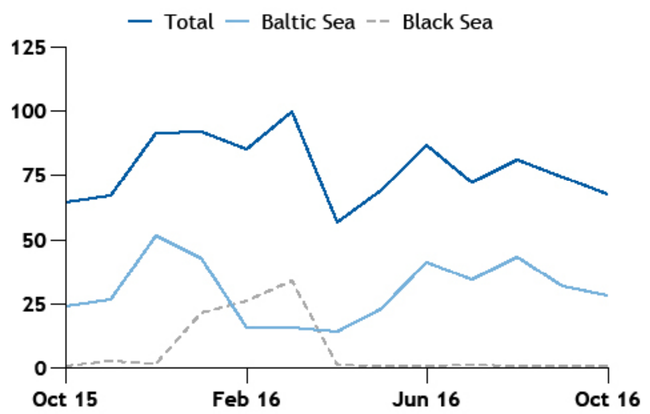
Prices for SN 500 began the year at around $520/t, then eased to around $470-480/t fob in the last few weeks of the first quarter. They rebounded to $560-570/t by the end of the second quarter before slipping back to $520-530/t in the third quarter. Prices edged even lower in the fourth quarter to less than $500/t, before rebounding in December along with light-grade and crude prices.

Prices for SN 150 and SN 500 began to edge lower at the start of the year. But the pace of the drop was muted compared with the steep slump in crude prices at the time. Base oil values consequently surged relative to feedstock prices.

Baltic exports surge in January-February

Supply was plentiful, with shipments from Baltic ports surging in the first two months of the year. The increase in availability contrasted with the persistent supply tightness from Baltic ports throughout most of 2015. The increase reflected a recovery in supplies from Lukoil's 460,000 t/yr Group I plant at its Perm refinery. These extended their rebounded through the year, with supplies from the plant reaching 171,000t in the first 10 months of 2016. That was up from just 64,000t during the same period the previous year.

Russian rail exports via Baltic/Black Sea *'000 t*



Baltic Sea Group I	Low	High	±
$/t			
SN 150 fob	510.00	550.00	+80.00
SN 500 fob	520.00	560.00	+15.00

Black Sea Group I	Low	High	±
$/t			
SN 150 fob	450.00	490.00	+0.00
SN 500 fob	520.00	560.00	+60.00

Naushki Group I	Low	High	±
$/t			
SN 150 cpt	370.00	410.00	+105.00
SN 500 cpt	470.00	510.00	+155.00

Russian base oils, lubes rail/river exports *'000t*

	Nov	Oct	±		Nov	Oct	±
Rail							
Overland	**33.32**	**30.77**	**+2.55**	**Baltic**	**24.82**	**27.78**	**-2.96**
Afganistan	0.00	0.06	-0.06	Kaliningrad	8.85	11.01	-2.16
Armenia	0.00	0.00	+0.00	Liepaja	3.55	7.62	-4.07
Azerbaijan	0.65	1.01	-0.36	Riga	11.78	8.11	+3.67
Belarus	0.93	1.77	-0.84	Ventspils	0.00	0.59	-0.59
China	3.23	0.47	+2.76	St.Petersburg	0.64	0.45	+0.19
Hungary	0.00	0.12	-0.12				
North Korea	0.00	0.00	+0.00	**Black Sea**	**2.52**	**0.47**	**+2.05**
Finland	1.32	1.30	+0.02	Temryuk	1.69	0.00	+1.69
Kazakhstan	5.13	0.75	+4.38	Yeisk	0.00	0.00	+0.00
Kyrgyzstan	0.86	0.75	+0.11	Kavkaz	0.83	0.30	+0.53
Latvia	2.74	7.21	-4.47	Novorossiysk	0.00	0.17	-0.17
Lithuania	3.72	2.46	+1.26	Reny	0.00	0.00	+0.00
Moldova	0.17	0.06	+0.11	Odessa	0.00	0.00	+0.00
Mongolia	0.41	0.49	-0.08	Azov	0.00	0.00	+0.00
Romania	0.15	0.65	-0.50				
Poland	1.02	0.85	+0.17	**River**			
Georgia	0.06	0.00	+0.06	Volgograd	18.33	12.59	+5.74
Tajikistan	1.52	1.18	+0.34				
Turkmenistan	0.09	0.31	-0.22	**Far East**			
Ukraine	10.39	10.53	-0.14	Nakhodka	4.61	3.38	+1.23
Uzbekistan	0.93	0.80	+0.13				
Total Russia rail, river exports					**84.17**	**80.00**	**+4.17**

Russian base oil, lubes rail/river exports by supplier *'000t*

	Nov	Oct	±		Nov	Oct	±
Volgograd	27.01	21.52	+5.49	Yaroslavl	1.46	3.64	-2.18
by rail	8.68	8.93	-0.25	Ufa	2.34	1.25	+1.09
by river	18.33	12.59	+5.74	Orgkhim	5.36	4.23	+1.13
N.Novgorod	0.00	0.00	+0.00	Obninsk	1.87	1.63	+0.24
Perm	15.67	19.93	-4.26	Sofrino	1.02	1.30	-0.28
Novokuibyshevsk	6.99	7.79	-0.80	Orenburg	0.00	0.00	+0.00
Angarsk	3.40	0.47	+2.93	Omsk	6.15	5.53	+0.62
Nizhnekamsk	7.02	9.76	-2.74	Other	5.88	2.95	+2.93
Total					**84.17**	**80.00**	**+4.17**

RUSSIA AND FSU

While supplies rose and crude prices fell, prices in the Baltic market got support from a wide open arbitrage to Europe. The premium of domestic Europe SN 500 prices to Baltic prices held at more than $200/t for two months to early February.

The relative strength of European prices and the region's stronger demand for Baltic supplies coincided with the closure of two Group I base oil plants in northwest Europe in the first half of 2016. Blenders and trading firms built up inventories, especially with supplies from the Baltic market, in anticipation of supply tightness following these closures.

But the arbitrage closed from early March as European prices fell in response to plentiful availability.

Exports slow on maintenance, strong domestic demand

Baltic prices held steady at that time as producers began to curb exports ahead of planned shutdowns for maintenance work that mostly took place in March and April.

While they trimmed supplies to Baltic buyers, producers also boosted exports to regional markets such as Ukraine, where buyers were willing to pay much higher prices than in the Baltic market. They also kept more supplies within Russia's domestic market. Demand in that market surged throughout most of the year. The depreciation of the rouble relative to the US dollar added to domestic blenders' attraction of buying supplies from Russian producers.

Strong domestic and regional demand, combined with some maintenance work in the fourth quarter of the year, maintained that tight availability of light grades into the last few months of 2016. That, combined with tight availability in Europe, helped to spur a strong price rebound in November and December.

Russian and Belarusian base oil export duty * *$/t*

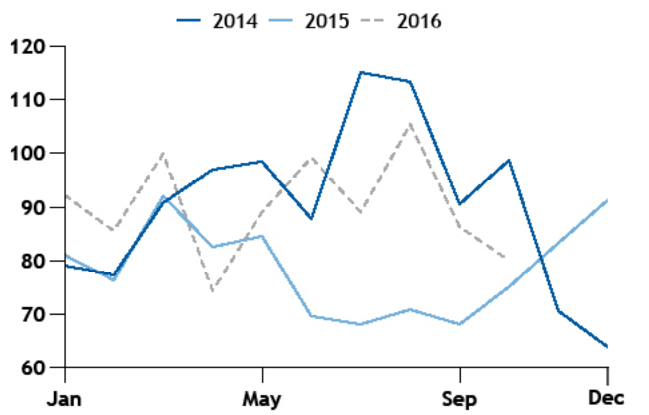
Jan 2017	Dec 2016	Nov 2016	Oct 2016	Sep 2016	Aug 2016
23.70	36.10	37.00	36.70	32.00	36.00
Jul 2016	**Jun 2016**	**May 2016**	**Apr 2016**	**Mar 2016**	**Feb 2016**
38.30	32.20	26.40	21.90	15.80	20.80

** tax paid by producer for base oils export outside of Russia, Belarus, Kazakhstan, Tajikistan and Kyrgyzstan*

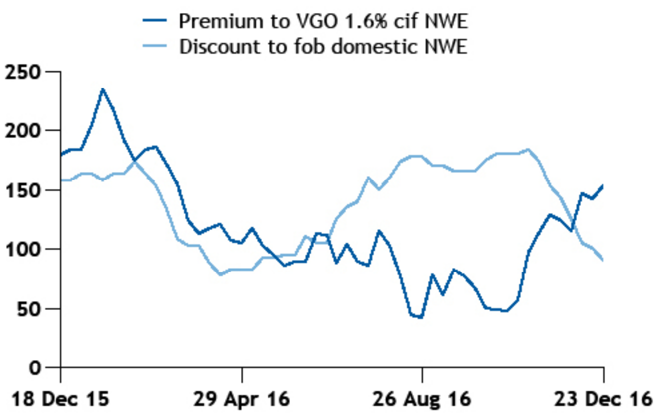
Russian domestic base oil supplies *'000t*

Supplier	Nov. 16	± Oct. 16
Lukoil Volgograd	10.06	2.04
Rosneft Novokuibyshevsk	18.73	1.22
Bashneft Ufa	11.61	-2.73
Lukoil Perm	10.24	2.03
Rosneft Angarsk	6.75	3.47
Gazpromneft Omsk	7.70	0.09
Gazpromneft/Rosneft Yaroslavl	6.88	0.61
Orgkhim	3.23	0.30
Tatneft Nizhnekamsk	4.45	1.04
Rosa-1	0.35	0.11
Lukoil Tyumen	0.36	-0.41
Shaumyan lube plant	0.00	0.00
Devon Group	0.35	0.11
Sofrino lube plant	0.10	0.04
Rosneft Ryazan	0.65	0.30
Experimental plant Neftekhim	0.00	-0.06
Obninskorgsintez	0.00	-0.06
Others	51.87	-9.70
TOTAL	133.33	-1.60

Russian base oil and lubricants rail exports *'000 t*



Baltic SN 150 vs VGO, vs domestic NWE *$/t*



RUSSIA AND FSU

Baltic prices for heavy-grade base oils rose strongly in the second quarter of the year, peaking in June at around $560-570/t fob. Prices got a boost from a revival in demand from west Africa in the second and third quarters of the year. Financial issues with shipments to Nigeria had curbed such supplies earlier in the year.

Baltic supplies face competition from US cargoes

But the Baltic market faced growing competition from US producers for the African market. Supplies from the Baltic market, and a surge in shipments from the US in the third quarter, covered requirements from that market and curbed demand late in the third quarter and into the fourth quarter of the year.

Unlike light-grade base oils, prices for heavy grades then faced downward pressure in the last few months of the year, when demand typically slows and supplies rise.

In the Black Sea market, prices for SN 150 fell steadily from $480/t fob to around $370/t in the first five months of the year. Prices recovered briefly in June and July, before resuming their slide throughout the third quarter and bottoming at around $380/t in September. They then recovered gradually in the fourth quarter, ending the year at around $470-480/t.

Prices for SN 500 dipped to around $400/t in May, after falling steadily from around $480/t fob at the start of the year. Prices recovered to $460-470/t in July, before easing back to $410-420/t by the end of the third quarter. Prices then recovered gradually in the fourth quarter, climbing to more than $520/t in December.

Weak Turkish demand squeezes prices

Prices fell more steeply than Baltic prices in the first half of the year, amid steady availability and a sustained slowdown in demand from Turkey. Turkish base oil imports from Russia fell to 58,000t in the first half of 2016, down from 73,000t during the same period in 2015. A steady flow of supplies from Iran to UAE and India also curbed demand from those markets for Russian supplies.

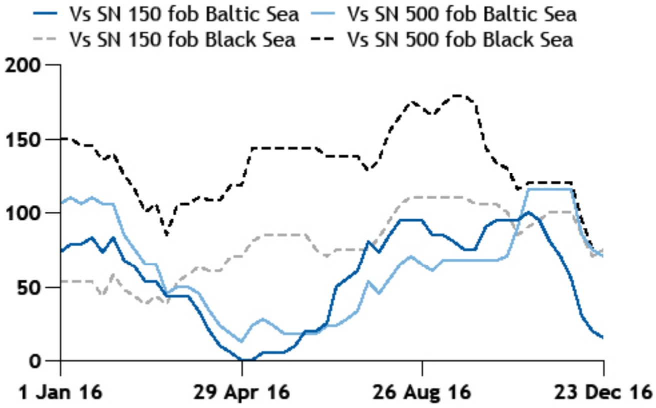
But price weakness left SN 500 prices more than $100/t lower than Baltic prices for around six months to the end of September. This incentivised refiners to direct shipments to the Baltic market or to other regional buyers willing to pay higher prices. The subsequent lack of supplies in the Black Sea market curbed opportunities to tap an unusually wide arbitrage to markets such as India and east Asia, although a steady flow of shipments moved to the UAE.

Turkish buyers turn to European supplies

The supply tightness also forced Turkish buyers to turn to other markets such as Europe to cover more of their requirements, especially for heavy grades. Black Sea prices subsequently began to firm late in the third and in the fourth quarter of the year. Their room for any substantial price recovery was curbed by competitively-priced domestic supplies in Turkey, although these prices were raised several times in the fourth quarter.

Heavy-grade prices in the Naushki market held in a $300-440/t range throughout the year, with values surging close to the high end of that range in the three months to June. The higher price level coincided with the surge in Group I and Group II heavy-grade prices in China during the first half of the year. Prices in China rose on the back of a seasonal increase in demand and tighter supplies caused by the shutdown of a major regional Group II plant in mid-year. Prices mostly held onto those gains in the third quarter of the year as the shutdown of Rosneft's Angarsk plant in September slashed supplies to China. Stock replenishment in the fourth quarter of the year then supported prices during that period.

European export vs Baltic/Black Sea $/t



US

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

US base oil prices were mixed in 2016. Paraffinic light and heavy grade prices eased in the first quarter of the year amid a seasonal slowdown in demand and a drop in crude prices to a 13-year low. Prices then firmed in the second quarter of the year on the back of higher crude prices and balanced supplies.

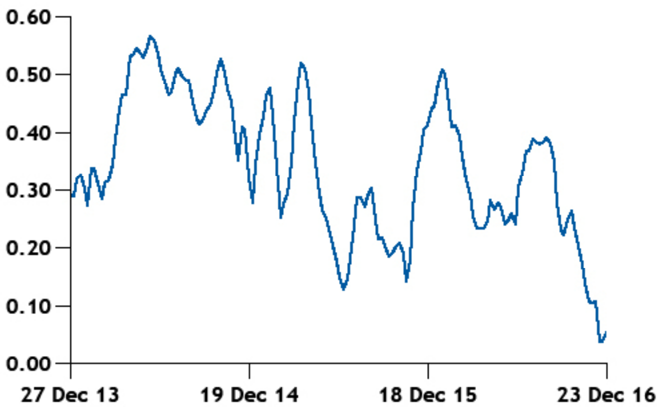
A round of Group II refinery maintenance in the first quarter and run-cuts in the second quarter curbed the build-up of surplus light grades. A pick-up in domestic demand during the spring oil-change season supported firmer prices for the light grades.

Base oil prices then eased in the second-half of 2016 amid a seasonal slowdown in demand. But heavy grade prices fell at a slower pace during the second half of the year. The steadier pricing reflected the more balanced supplies of the heavy grades. Like in 2015, Group II N600 supplies were limited in the second-half of the year. The Group II heavy grade supplies were in short supply because of reduced production caused by refinery maintenance in the second and fourth quarters of 2016.

But unlike 2015, bright stock was the worst performing grade. Prices for the Group I heavy grade fell throughout 2016. Bright stock prices remained under pressure all year from a persistent overhang amid increased domestic production.

Producers managed their surplus supplies throughout the year with run cuts and steady exports. When base oil prices weakened relative to competing fuels, producers shifted their feedstocks and light grades to the distillate stream to maximise motor fuels output. The increased exports helped to offset weaker domestic demand in 2016.

US SN 150 domestic premium to heating oil $/USG



Argus USGC domestic prices

	$/USG			$/t		
	Low	High	±	Low	High	±
Group I						
SN 150	1.62	1.78	+0.05	491.00	539.00	+15.00
SN 500	2.17	2.33	-0.29	647.00	694.00	-85.00
Bright stock	2.82	2.98	-0.55	829.00	876.00	-162.00
Group II						
N100	1.59	1.75	+0.18	493.00	543.00	+54.50
N220	1.61	1.77	+0.11	491.00	540.00	+33.50
N600	2.34	2.50	-0.32	702.00	750.00	-96.00
Group III						
4cst	2.61	2.77	-0.03	822.00	873.00	-9.50
6cst	2.60	2.76	-0.06	819.00	869.00	-19.00
8cst	2.82	2.98	+0.08	888.00	939.00	+25.00

Volume: 50t minimum

Argus USGC Group I bulk export prices

	$/USG			$/t		
	Low	High	±	Low	High	±
SN 150 fob	1.55	1.71	+0.09	470.00	518.00	+27.50
SN 500 fob	1.70	1.86	-0.61	507.00	554.00	-181.50
Bright stock fob	2.22	2.38	-0.90	653.00	700.00	-264.00

Volume: 1,000t minimum

Argus USGC Group II bulk export prices

	$/USG			$/t		
	Low	High	±	Low	High	±
N100 fob	1.53	1.69	+0.19	474.00	524.00	+59.00
N220 fob	1.56	1.72	+0.19	476.00	525.00	+58.00
N600 fob	2.28	2.44	-0.37	684.00	732.00	-111.00

Volume: 1,000t minimum

Argus USGC naphthenic domestic prices

	$/USG			$/t		
	Low	High	±	Low	High	±
Pale oil 60	2.17	2.33	nc	643.00	690.00	nc
Pale oil 100	2.17	2.33	-0.17	636.00	683.00	-50.00
Pale oil 500	2.13	2.29	-0.18	612.00	658.00	-52.00
Pale oil 2000	2.20	2.36	-0.22	628.00	673.00	-62.50

Volume: 20t minimum

Argus USGC naphthenic bulk export prices

	$/USG			$/t		
	Low	High	±	Low	High	±
Pale oil 60 fob	1.70	1.86	+0.13	504.00	551.00	+38.50
Pale oil 100 fob	1.69	1.85	+0.16	495.00	542.00	+47.00
Pale oil 500 fob	1.68	1.84	+0.12	483.00	529.00	+35.00
Pale oil 2000 fob	1.71	1.88	+0.09	488.00	536.00	+27.00

Volume: 1,000t minimum

US

Low-high price as of 23 Dec 2016. "+/-" refers to price change vs 24 Dec 2015.

Planned maintenance at several Group II refineries throughout the year kept surplus supplies of the light- and mid-viscosity grades at manageable levels. The smaller surplus of Group II supplies allowed producers to be more selective about the export markets they targeted. Group II producers prioritized higher-value export markets in Latin America and Europe over lower-value markets such as India. More US Group II supplies with and without approvals moved to the European market in 2016.

US Group II producers only sent a few shipments of their surplus supplies to India. Several shipments of US Group II supplies moved to India and China in the second quarter of 2016 amid a surge in Group II demand and prices in those markets.

Group I supplies head to Africa, Venezuela

Group I refineries had a light maintenance year. Producers had surplus supplies of all grades throughout most of the year. Producers exported most of their surplus supplies to Mexico and other outlets in Latin America. Large volumes of heavy neutrals and bright stock also moved to Nigeria, Venezuela and India in the second half of the year.

Most surplus US Group I and Group II supplies moved into the Mexican market. Mexican demand for light grades held firm all year for use as a fuel extender.

Base oil grades that were limited in 2015 faced oversupply and increased availability in 2016. The shortage of bright stock in 2015 turned to oversupply in 2016. Group III light- and mid-viscosity supply availability also improved as more imports of the premium-grade base oils targeted the US.

US bright stock prices faced pressure through 2016 as production outpaced demand.

Several Group I plant closures in Europe and the US Gulf coast in early 2016 were expected to tighten availability of bright stock in the Americas. But several US refiners responded to persistently-firm bright stock margins and expectations of tightness by boosting their production in 2015. Instead of tightness in 2016, the US had an overhang of bright stock throughout the whole year. As a result, the discount of the *Argus* bright stock spot price to US posted prices increased in the third quarter of 2016 to its widest level in more than six years.

Bright stock capacity rises

Another US producer increased its bright stock output in 2016. Ergon made modifications to its 25,000 b/d Vicksburg, Mississippi refinery in 2016 to produce as much as 150,000 t/yr (1mn bl/yr) of Group I bright stock from the third quarter of 2016. The new Group I bright stock product is not an exact drop-in replacement for paraffinic Group I bright stock. Its viscosity index is lower than usual. But its viscosity is much higher than usual. The new product also has a lower-than-usual pour point and higher-than-usual flash point. Even with these differences, the product is expected to attract demand from blenders producing lubricants like marine lubricants and monograde engine oils.

The ready supplies of bright stock mirror the improved availability of Group III base oils.

Group III availability increased following an influx of 4cst and 6cst base oils to the US from new sources in the second half of 2016. More Group III base oils with limited or no OEM approvals from new supply sources moved to the US throughout the third quarter of the year.

US SN 500 forward prices

	$/USG			$/t		
	Low	High	±	Low	High	±
Jan 2017	1.76	1.81	-0.61	523.00	537.90	-181.75
Feb 2017	1.77	1.82	-0.62	527.75	542.65	-185.75
Mar 2017	1.78	1.83	-0.64	530.85	545.75	-190.10
1Q 2017	1.77	1.82	-0.62	527.20	542.10	-185.90
2Q 2017	1.79	1.84	-0.67	533.20	548.10	-199.10

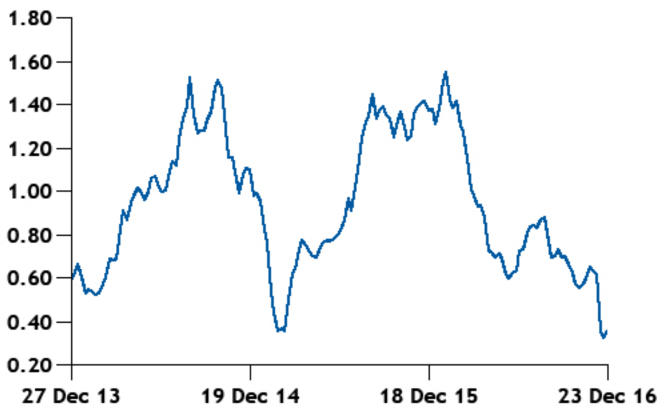
The price shows the implied forward-curve base oil price required to maintain its existing profit margin relative to Nymex heating oil futures. Refer to www.argusmedia.com for methodology

US SN 500 forward premium to heating oil

	$/USG		$/t	
	Midpoint	±	Midpoint	±
Jan 2017	0.15	-0.99	45.55	-295.30
Feb 2017	0.14	-0.97	40.80	-291.30
Mar 2017	0.13	-0.96	37.70	-286.95
1Q 2017	0.14	-0.98	41.70	-292.05
2Q 2017	0.12	-0.93	35.75	-277.15

The premium shows the implied forward-curve profitability of fob US export SN 500 relative to Nymex heating oil futures. Refer to www.argusmedia.com for methodology

US SN 500 premium to VGO 2% *$/USG*



US

UAE, Russia Group III supplies head to US

Two large shipments of Group III base oils with limited approvals from a new plant in the Mideast Gulf moved to the US Gulf coast. The first shipment of 10,000t made up of 4cst and 6cst arrived in July. The second shipment of mostly 4cst arrived in mid-September. Several batches of flexibag supplies of Russian 4cst base oils without approvals also moved to the US Gulf and east coasts since mid-July.

The additional Group III supplies put pressure on prices for the light- and mid-viscosity grades.

US naphthenic base oil prices mostly eased in 2016 because of pressure from competitive pricing and volatile crude prices.

Naphthenic prices fell during the first two months of the year in response to the steep drop in crude prices. Prices even eased as several refineries had planned and unplanned maintenance.

But the price drop was cushioned by tighter supplies caused by those plant shutdowns in the first quarter of 2016.

The turnarounds helped to curb the supply overhang that typically builds during the seasonal slowdown at year-end and in the first quarter of the year. Several refineries had no spot availability—especially of heavy grades— following the completion of their turnarounds in early March.

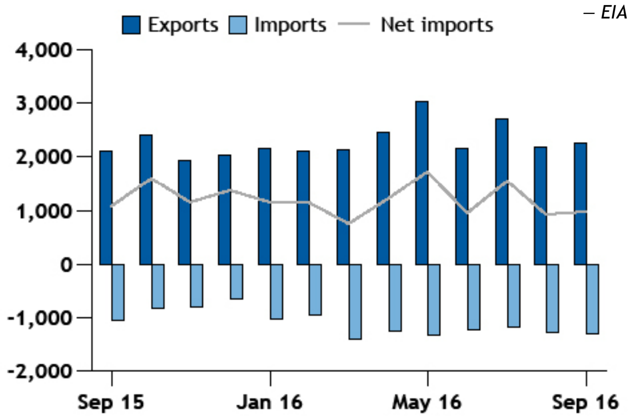
Heavy grade supplies remained limited through the first half of the year. But surplus supplies of all grades grew during the summer months amid a slowdown in seasonal demand and increased output among all producers.

A surplus overhang of mostly heavy grades in the third quarter of 2016 prompted widespread discounting in the domestic market. A second round of refinery maintenance in the third quarter helped to curb the heavy-grade supply overhang for some producers. The maintenance also helped to stabilise prices.

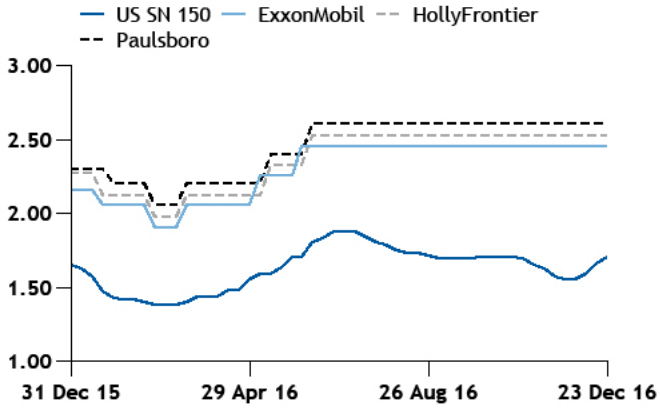
Naphthenic prices seesawed in response to the volatility in crude prices in the fourth quarter, but ended the year trending upwards.

US base oil exports, imports *'000 bl*

— EIA

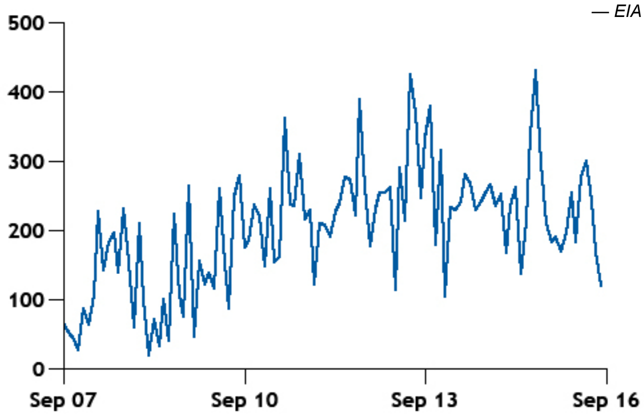


US domestic SN 150 vs posted prices *$/USG*

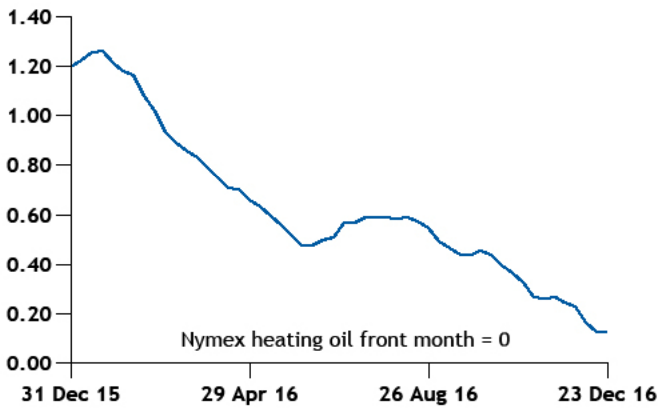


US base oil exports to Brazil *'000 bl*

— EIA



US SN 500 premium to heating oil *$/USG*



US POSTED PRICES *$/USG*

Group I *	ExxonMobil Gulf coast			HollyFrontier			Paulsboro Refining east coast			Calumet Shreveport		
	Effective	$/USG	±	Effective	$/USG	±	Effective	$/USG	±	Effective	$/USG	±
70/75				07 Jun 16	2.34	+0.20						
100	03 Jun 16	2.40	+0.20	07 Jun 16	2.34	+0.20	08 Jun 16	2.65	+0.20			
150	03 Jun 16	2.45	+0.20	07 Jun 16	2.52	+0.20	08 Jun 16	2.60	+0.20			
250				07 Jun 16	2.43	+0.20		PP				
300/350	03 Jun 16	2.32	+0.20									
500				07 Jun 16	3.25	+0.20	08 Jun 16	3.11	+0.20			
600/650	03 Jun 16	2.97	+0.20							09 Jun 16	3.35	+0.20
700							08 Jun 16	3.14	+0.20			
Bright stock	03 Jun 16	4.16	+0.20	07 Jun 16	4.19	+0.20	08 Jun 16	4.31	+0.20	09 Jun 16	4.34	+0.20

Group II *	Phillips 66 Gulf coast			Chevron Gulf coast			Motiva Gulf coast			FHR Gulf coast		
	Effective	$/USG	±	Effective	$/USG	±	Effective	$/USG	±	Effective	$/USG	±
70	03 Jun 16	2.35	+0.20							19 Dec 16	2.40	+0.10
75/80	03 Jun 16	2.35	+0.20							19 Dec 16	2.40	+0.10
100/120	03 Jun 16	2.30	+0.20	24 Aug 16	2.50	+0.20	04 Oct 16	2.02	-0.15	19 Dec 16	2.34	+0.10
200/220	03 Jun 16	2.45	+0.20	24 Aug 16	2.60	+0.20	04 Oct 16	2.10	-0.17	19 Dec 16	2.42	+0.10
600	04 Oct 16	3.10	+0.10	24 Aug 16	3.20	+0.20	04 Oct 16	2.65	-0.10	19 Dec 16	3.06	+0.10

Group II *			
ExxonMobil Gulf coast	Effective	$/USG	±
200/220	03 Jun 16	2.54	+0.20

Group II *			
Calumet Shreveport	Effective	$/USG	±
80	09 Jun 16	2.59	+0.20
100	09 Jun 16	2.46	+0.20
150	09 Jun 16	2.89	+0.20
325	09 Jun 16	3.20	+0.20

Group II+ *	SK Lubricants Gulf coast			Phillips 66 Gulf coast		
	Effective	$/USG	±	Effective	$/USG	±
50/60				09 Jun 16	3.57	+0.20
70/80	09 Jun 16	3.79	+0.10	09 Jun 16	3.67	+0.20

Group II+ *			
ExxonMobil Gulf coast	Effective	$/USG	±
110/130	03 Jun 16	2.92	+0.20

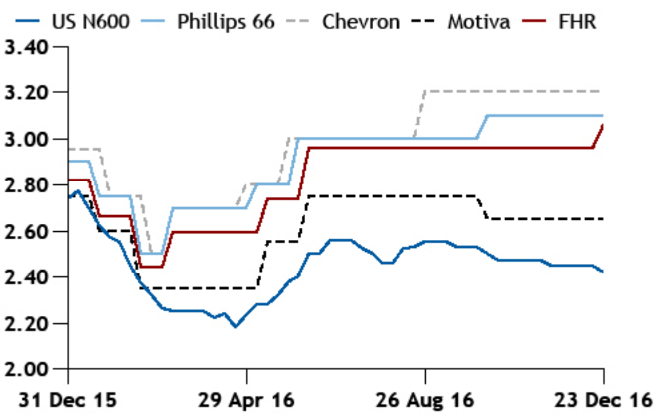
Group II+ *			
Kleen Performance Products	Effective	$/USG	±
110/130	06 Jun 16	2.92	+0.20
240	06 Jun 16	2.92	+0.20

**the ± column shows the price difference between the current and previous posted price*

Group III *	SK Lubricants Gulf coast			Phillips 66 Gulf coast		
	Effective	$/USG	±	Effective	$/USG	±
4cst	09 Jun 16	4.11	+0.10	09 Jun 16	3.88	+0.20
6cst	09 Jun 16	4.11	+0.10			
8cst	09 Jun 16	4.14	+0.10	09 Jun 16	3.98	+0.20

Avista Oil midwest/east coast *			
	Effective	$/USG	±
Group I SN 150	10 Jun 16	2.45	na
Group II N150	10 Jun 16	2.55	na
Group II+ N110/130	10 Jun 16	2.87	na

US domestic N600 vs posted prices $/USG



US POSTED PRICES *$/t*

Group I *

	ExxonMobil Gulf coast			HollyFrontier			Paulsboro Refining east coast			Calumet Shreveport		
	Effective	$/t	±	Effective	$/t	±	Effective	$/t	±	Effective	$/t	±
70/75				07 Jun 16	725.40	+62.00						
100	03 Jun 16	739.20	+61.60	07 Jun 16	720.72	+61.60	08 Jun 16	813.55	+61.40			
150	03 Jun 16	752.15	+61.40	07 Jun 16	773.64	+61.40	08 Jun 16	785.20	+60.40			
250				07 Jun 16	738.72	+60.80						
300/350	03 Jun 16	702.96	+60.60									
500				07 Jun 16	981.50	+60.40	08 Jun 16	933.00	+60.00			
600/650	03 Jun 16	885.06	+59.60							09 Jun 16	998.30	+59.60
700							08 Jun 16	929.44	+59.20			
Bright stock	03 Jun 16	1,235.52	+59.40	07 Jun 16	1,244.43	+59.40	08 Jun 16	1,275.76	+59.20	09 Jun 16	1,288.07	+59.36

Group II *

	Phillips 66 Gulf coast			Chevron Gulf coast			Motiva Gulf coast			FHR Gulf coast		
	Effective	$/t	±	Effective	$/t	±	Effective	$/t	±	Effective	$/t	±
70	03 Jun 16	728.50	+62.00							19 Dec 16	744.00	+31.00
75/80	03 Jun 16	719.10	+61.20							19 Dec 16	734.40	+30.60
100/120	03 Jun 16	711.28	+61.85	24 Aug 16	772.50	+61.80	04 Oct 16	626.20	-46.50	19 Dec 16	723.65	+30.92
200/220	03 Jun 16		+60.95	24 Aug 16	793.00	+61.00	04 Oct 16	640.50	-51.85	19 Dec 16	737.50	+30.48
600	04 Oct 16	934.65	+30.15	24 Aug 16	964.80	+60.30	04 Oct 16	800.30	-30.20	19 Dec 16	922.59	+30.15

Group II *

ExxonMobil Gulf coast	Effective	$/t	±
200/220	03 Jun 16	774.70	+61.00

Group II *

Calumet Shreveport	Effective	$/t	±
80	09 Jun 16	799.27	+61.72
100	09 Jun 16	755.86	+61.45
150	09 Jun 16	885.38	+61.27
325	09 Jun 16	974.94	+60.93

Group II+ *

	SK Lubricants Gulf coast			Phillips 66 Gulf coast		
	Effective	$/t	±	Effective	$/t	±
50/60				09 Jun 16	1,151.33	+64.50
70/80	09 Jun 16	1,193.85	+31.50	09 Jun 16	1,174.40	+64.00

Group II+ *

ExxonMobil Gulf coast	Effective	$/t	±
110/130	03 Jun 16	913.96	+62.60

Group II+ *

Kleen Performance Products	Effective	$/t	±
110/130	06 Jun 16	910.16	+62.34
240	06 Jun 16	904.91	+61.98

**the ± column shows the price difference between the current and previous posted price. The $/t price is converted from the $/USG price.*
Refer to www.argusmedia.com for methodology with the gallons-to-tonnes conversion factors.

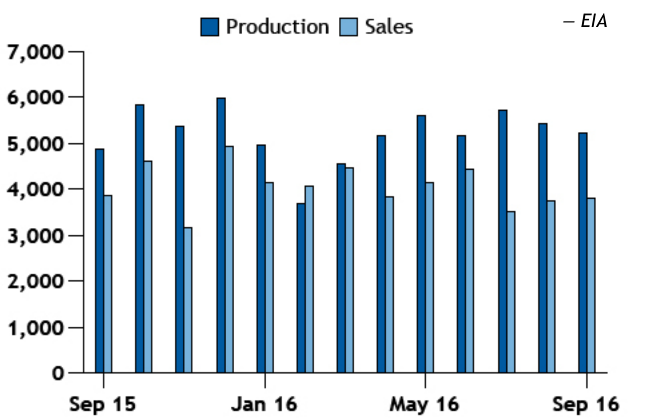
Group III *

	SK Lubricants Gulf coast			Phillips 66 Gulf coast		
	Effective	$/t	±	Effective	$/t	±
4cst	09 Jun 16	1,294.65	+31.50	09 Jun 16	1,231.90	+63.50
6cst	09 Jun 16	1,294.65	+31.50			
8cst	09 Jun 16	1,304.10	+31.50	09 Jun 16	1,245.74	+62.60

Avista Oil midwest/east coast *

	Effective	$/t	±
Group I SN 150	10 Jun 16	762.39	na
Group II N150	10 Jun 16	793.51	na
Group II+ N110/130	10 Jun 16	895.50	na

US base oil production, sales *'000 bl*



MAINTENANCE AND SHUTDOWNS

Upcoming / recent base oil plant maintenance / shutdowns / closures					
Refiner	**Location**	**Timing**	**Capacity**	**Capacity affected**	**Cause**
Sinopec	Jingmen, China	15 Dec 2016 for 30-40 days	400,000 t/yr	200,000 t/yr	Maintenance
Avista Oil	Peachtree, Georgia, US	End-Nov 2016 for 4-5 days	1,250 b/d	All	Maintenance
Vertex Energy	Columbus, Ohio, US	Mid-Nov 2016 for 1 week	1,500 b/d	All	Maintenance
HCC	Indianapolis, Indiana, US	Nov 7 2016 for 3-4 days	2,500 b/d	All	Maintenance
HPCL	Mumbai, India	28 Nov 2016 for 45 days	480,000 t/yr	225,000 t/yr	Maintenance
Chevron	Richmond, California, US	End-Sep 2016 for 50-55 days	1,020,000 t/yr	NA	Maintenance
S-Oil	Onsan, South Korea	20 Oct 2016 for 30-40 days	41,000 b/d	28,000 b/d	Maintenance
Sepahan	Isfahan, Iran	1H Oct 2016 for 3-4 weeks	485,000 t/yr	Partial	Maintenance
Pemex	Salamanca, Mexico	Oct 11 2016 for 3-4 weeks	6,000 b/d	All	Maintenance
Naftan	Novopolotsk, Belarus	Oct 5 2016 for 1 month	200,000 t/yr	All	Maintenance
Lotos	Gdansk, Poland	Oct 2016	245,000 t/yr	NA	Maintenance
Shell	Pulau Bukom, Singapore	End-Sep 2016	380,000 t/yr	All	Maintenance
Eni	Livorno, Italy	End-Sep 2016 for 50 days	645,000 t/yr	All	Maintenance
Gazpromneft	Omsk, Russia	Sep 2016	230,000 t/yr	Partial	Maintenance
Rosneft	Angarsk, Russia	5 Sep 2016 for 4 weeks	250,000 t/yr	All	Maintenance
JX Nippon	Negishi, Japan	Sep 20 2016 for 2 months	210,000 t/yr	All	Maintenance
Sinopec	Shanghai, China	1H Sep 2016 for 2 weeks	600,000 t/yr	All	Maintenance
Petrochina	Daqing, China	Mid-Aug 2016 for 1 month	275,000 t/yr	NA	Maintenance
Thai Lube	Siracha, Thailand	2H Aug 2016 for 1 month	275,000 t/yr	NA	Maintenance
Calumet	Princeton, Louisiana, US	2H Aug 2016 for 2 weeks	6,900 b/d	Partial	Maintenance
Iranol	Tehran, Iran	Aug-Sep 2016	225,000 t/yr	All	Maintenance
Ergon Refining	Vicksburg, Mississippi, US	Aug 2016 for 4 weeks	25,000 b/d	Partial	Maintenance
Pertamina	Cilacap, Indonesia	End-Jul 2016 for 20-25 days	440,000 t/yr	All	Maintenance
HCC	Indianapolis, Indiana, US	Mid-Jul for 1 week	2,500 b/d	All	Maintenance
Bazan Group	Haifa, Israel	End-Jul to 2H Sep 2016	75,000 t/yr	All	Maintenance
Sinopec	Jingmen, China	1H Jul 2016 for 20 days	400,000 t/yr	150,000 t/yr	Maintenance
Sinopec	Shanghai, China	1H Jul 2016 for 35 days	600,000 t/yr	300,000 t/yr	Maintenance
MOL	Szazhalombatta, Hungary	Jul 2016 for 4 weeks	150,000 t/yr	All	Maintenance
Sinopec	Shanghai, China	2H Jun 2016 for 1 month	600,000 t/yr	300,000 t/yr	Maintenance
SK Lubricants	Ulsan, South Korea	Late Jun to mid-Jul 2016	300,000 t/yr	All	Maintenance
Formosa	Mailiao, Taiwan	2H Jun to 20 Aug 2016	520,000 t/yr	All	Maintenance
Avista Oil	Peachtree, Georgia, US	2H Jun 2016 for 1 week	1,250 b/d	All	Maintenance
Excel Paralubes	Westlake, Louisiana, US	2H Jun 2016	22,000 b/d	Partial	Maintenance
JX Nippon	Mizushima B, Japan	Mid-Jun for 2 months	225,000 t/yr	All	Maintenance
Shandong Hengrunde	Shandong, China	2H May 2016 for 30 days	150,000 t/yr	All	Maintenance
Panjin Northern	Liaoning, China	15 May 2016 for 20-30 days	400,000 t/yr	NA	Maintenance
San Joaquin Ref	Bakersfield, California, US	Early May 2016 for 3 weeks	8,100 b/d	NA	Maintenance
Sapref	Durban, South Africa	May 2016	170,000 t/yr	All	Maintenance
Repsol	Cartagena, Spain	Apr 2016	135,000 t/yr	NA	Maintenance
Lukoil	Perm, Russia	Apr 2016 for 45 days	460,000 t/yr	NA	Maintenance
Rosneft	Novokuibyshevsk, Russia	Apr 2016 for 3 weeks	350,000 t/yr	All	Maintenance
American Refining	Bradford, US	Apr 2016 for 2 weeks	2,400 b/d	NA	Maintenance
Ergon	Newell, West Virginia, US	42461	4,800 b/d	All	Maintenance
HPCL	Mumbai, India	Apr 2016 for 1 month	480,000 t/yr	225,000 t/yr	Maintenance
Hainan Handi	Hainan, China	1 Mar for 30 days	300,000 t/yr	All	Maintenance
Lukoil	Volgograd, Russia	Mar 2016	560,000 t/yr	Partial	Maintenance
Gazpromneft	Omsk, Russia	Mid-Feb to 1H Apr 2016	230,000 t/yr	115,000 t/yr	Maintenance
Excel Paralubes	Westlake, Louisiana, US	2H Feb 2016	22,000 b/d	Partial	Maintenance

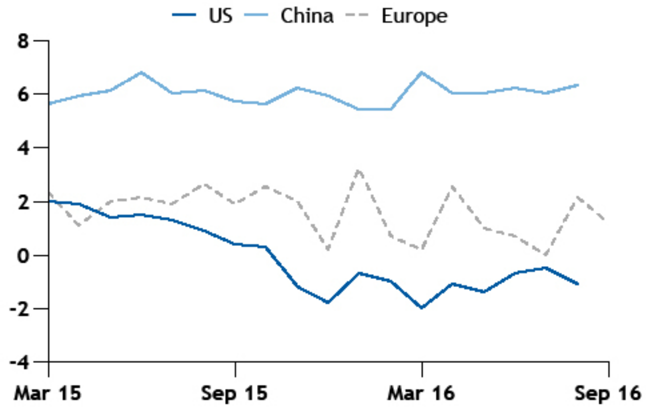
Every effort has been made to verify information directly with appropriate company sources. Some information has been obtained from usually reliable sources, but cannot be officially confirmed with the refinery concerned. The list will be updated when new information becomes available.

MARKET FUNDAMENTALS

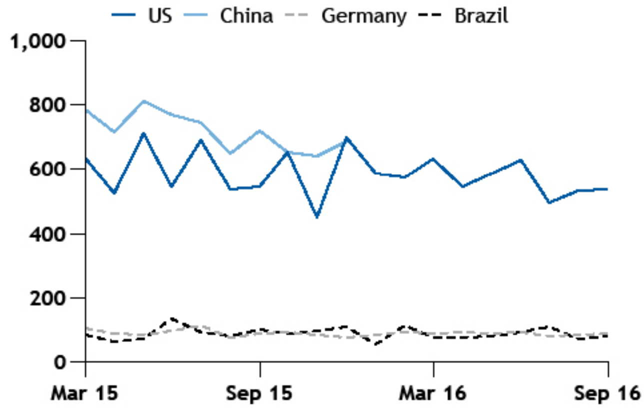
Sep 2016	Industrial overview				Lube/base oils overview											
	Automobile sales			Industrial growth	Production			Sales			Import			Export		
	'000	*Mom%*	*Yoy%*	*Yoy%*	*'000t*	*Mom%*	*Yoy%*	*'000t*	*Mom%*	*Yoy%*	*'000t*	*Mom%*	*Yoy%*	*'000t*	*Mom%*	*Yoy%*
China	2,268	+26	+30	+0.00	0.0	+0	+0	†	+0	+0	191.0	+1	-14	1.0	-50	-10
Japan*	477	+42	-1	+1.50	173.8	-5	+4	112.0	+13	-8	4.6	-64	-82	67.4	-8	+14
Europe	1,455	+78	+7	+1.20												
US*	1,436	-5	-0	-1.00	737.6	-4	+7	535.1	+1	-2	184.6	+3	+24	318.7	+4	+7
France	169	+72	+2	-1.00				49.0	+32	-3						
Germany	298	+22	+9	+1.20	27.0	-10	+13	87.0	+3	-1	67.0	+8	+19	22.0	+96	-2
Italy	154	+115	+17	+1.80				37.0	+48	+0						
Russia	126	+10	-11	-0.80										86.1	-18	+27
Spain	80	+24	+14	+0.30				36.3	+39	+7						
Turkey	68	-6	+6	-3.10	4.1	-70	-50	25.3†	-38	-42	21.2	-21	-40	0.0	0	0
UK	470	+475	+2	+0.30	34.0	+113	-8	36.0	+16	+44						
Australia*	103	+8	+1		0.0	0	0	23.9	+0	-1	34.5	-15	+7	20.4	-49	+2
India	195	+10	+15	-1.90	82.0	-12	+0	304.0	+4	+18	165.0	-23	-22			
Singapore				+7.60							39.0‡	-22	-9	221.0‡	-15	+14
South Korea				-1.90							39.0	-11	-2	363.0	+19	+19
Taiwan*	33	+46	+33	+0.00	16.1^	+64	+7	13.7	+55	+63	9.2	+141	+24	43.3	+218	-23
Thailand*	64	+0	+3	+0.60	33.7	-17	-24	42.5†	-33	-14	0.0	+0	+0	10.6	-37	-45
Argentina*	68	+6	+11	+0.00	0.0	+0	+0				0.0	-21	-40	0.0	-100	-100
Brazil*	160	-13	-20	-4.80	31.0	-34	-33	77.1†	+9	-21	56.4	+61	+2	10.3	-10	+161
Mexico*	131	-2	+18	-1.40	12.7	-9	+25									

** The conversion factor used is 159 litres to a barrel and 7.1 barrels to a metric tonne. † Apparent demand. ‡ 4 weeks to end-month.*
^ Taiwan lube production plus imports

Global industrial growth *Yoy%*



Global lubricating oils demand *'000 t*



Sources: Country data for base oil and lube sales, production, imports and exports taken from national sources
US: Energy Information Administration. **Japan:** Petroleum Association of Japan. **Italy:** Unione Petrolifera. **Singapore: International Enterprise**. Country data for industrial production growth taken from national sources. Automobile sales data taken from national automobile associations. **US:** Autodata Corp. **Russia:** Association of European Businesses in the Russian Federation. **Australia:** Federal Chamber of Automotive Industries. **India:** Society of Indian Automobile Manufacturers. **Thailand:** Toyota Motor Thailand.

MARKET FUNDAMENTALS

Upcoming / recent expansions / conversions / new plants					
Refiner	**Location**	**Timing**	**New capacity**	**Grade**	**Expansion / new plant**
Sasol	Louisiana, US	After 2020	NA	GTL	New
Modrica refinery	Modrica, Bosnia	NA	200,000 t/yr	Group III	Expansion
Hengli Petrochemical	Dalian, China	2018	683,000t/yr	Group II and III	New
Pemex	Salamanca, Mexico	2018	3,300 b/d	Group II	Delayed
ExxonMobil	Rotterdam, Netherlands	2018	NA	Group II	New
Holly Frontier	Wood Cross, US	2018	10,000-12,000 b/d	Group III	Delayed
Luberef	Yanbu, Saudi Arabia	3Q 2017	715,000 t/yr	Group II	New
Petrobras	Comperj, Brazil	2017	355,000 t/yr	Group II	Cancelled
Neste	NA	By 2017	200,000 t/yr	Group III	Expansion
Hainan Handi	Hainan, China	End-2017	500,000 t/yr	Group II+/III	New
Slavneft	Yaroslavl, Russia	1Q 2017	100,000 t/yr	Grp III	New
S-Oil	Onsan, South Korea	Dec 2016	3,780 b/d	Grp II	Expansion
Panjin Northern Asphalt	Liaoning, China	Oct 2016	300,000 t/yr	Naphthenic base oils	New
CNOOC	Taizhou, China	Oct 2016	600,000 t/yr	Group II	New
VN Oil	Hiep Phuoc, Vietnam	3Q 2016	50,000 t/yr	Group II re-refinery	New
Ergon Refining	Vicksburg, US	3Q 2016	3,000 b/d	Group I bright stock	New
Adnoc	Abu Dhabi, UAE	Apr 2016	620,000 t/yr	500,000 t/yr Group III, 120,000 t/yr Group II	New
Shandong Qingyuan	Shandong,China	Jun 2016	600,000 t/yr	Group II	New
Jinling Petrochemical	Nanjing, China	Mar 2016	200,000 t/yr	Group II	New
Sinopec	Maoming, China	Jun 2016	400,000 t/yr	Group II+, Group III	Expansion
ExxonMobil	Singapore	1Q 2015	300,000 t/yr	Group II	Expansion
ExxonMobil	Baytown, US	1Q 2015	300,000 t/yr	Group II	Expansion
NIS, Serbia	Serbia	2015	180,000 t/yr	Group II/ naphthenic	Cancelled
Nynas	Harburg, Germany	2015	NA	350,000 t/yr naphthenic base oils	Conversion/expansion
Sinopec	Yanshan, China	2015	240,000 t/yr	Group II	Expansion
Tatneft	Nizhnekamsk, Russia	Dec 2014	186,000t /yr	Group II/III	New
SK Lubricants/Repsol	Cartagena, Spain	20 Sep 2014	630,000 t/yr	Group III 3-8cst	New
Shell/Hyundai Oilbank	Daesan, South Korea	Aug-Sep 2014	650,000 t/yr	Group II	New
Hengrunde Petrochemical	Shandong,China	Aug 2014	200,000 t/yr	Group II	New
Heritage-Crystal Clean	Indiana, US	Mid-2014	25mn USG/yr	Re-refined Group II light and mid-grade	Expansion
Naftan	Novopolotsk, Belarus	May 2014	72,000 t/yr	Group I	Conversion
Chevron	Pascagoula, US	July-Aug 2014	1.25mn t/yr	Group II	New
Southern Oil	Queensland, Australia	Mar 2014	100mn l/yr	NA	New
Puralube	Troeglitz, Germany	2014	50,000 t/yr	Group II	New
Hebei Feitian Petrochemical	Hebei, China	Q4 2013	100,000 t/yr	Group II	New
Shandong Qingyuan	Shandong, China	Early 2014	300,000 t/yr	Group I+	New
Panjin Northern Asphalt	Liaoning, China	Oct 2013	400,000 t/yr	Group II	Expansion
S-Oil	Onsan, South Korea	Oct 2013	3,000 b/d	Group III	Expansion
SK Lubricants	Ulsan, South Korea	Jun 2013	11,000 b/d	Group II heavy-grade, from Group III	Conversion
Avista Oil (US)	Peachtree, Georgia, US	May 2013	1,000 b/d	Group II	New
Lwart	Lencois Paulista, Brazil	Jan 2013	150,000 t/yr	Group II re-refinery	New
Naftan	Novopolotsk, Belarus	Nov 2012	NA	Add 6,000 t/month Group III	Conversion
Sinopec	Jinan, China	4Q 2012	50,000 t/yr	Group II and BS, from 100,000 t/yr Group I	Conversion/expansion
SK Lubricants/JX Energy	Ulsan, South Korea	May 2012	26,000 b/d	Group III	New
Heritage-Crystal Clean	Indiana, US	1Q 2012	30mn USG/yr	Re-refined Group II light grade	New
Lotos	Gdansk, Poland	2H 2012	NA	Add Group II	Conversion
PetroChina	Fushun, China	3Q 2011	NA	Only heavy-grade Group I	Conversion
GS Caltex	Yeosu, S. Korea	Jun 2011	3,000 b/d	Heavy-grade Group II	Expansion

Every effort has been made to verify information directly with appropriate company sources. The list will be updated when new information becomes available.

argusmedia.com

Argus Base Oils Preview 2017

Market Reporting

Petroleum

Consulting

illuminating the markets

Events

Contents

The Month Ahead:

Global base oil prices are expected to trend upwards in January as the market enters the peak-demand season. Unlike in late 2015 and early 2016, firmer crude prices in January should give blenders the confidence to proceed with their procurement plans. Refiners holding on to supplies in anticipation of higher prices further into the peak-demand season might curb availability and provide support to prices.

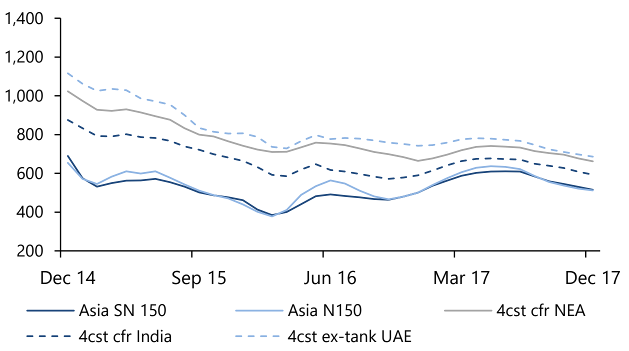
The next 3-6 months:

Base oil prices are expected to trend upwards in the first half of 2017, supported by a pick-up in seasonal demand and rising crude prices. But the earlier-than-usual stock replenishment by blenders in the fourth quarter of 2016 is expected to dampen the increase in demand in the first half of 2017. We subsequently expect prices to firm up at a faster pace in first-quarter 2017, with the momentum slowing nearer to the end of the second quarter this year. Plentiful availability of Group III and bright stock in the market is expected to put pressure on prices and limit the scope for any sharp price increase for those products.

Longer-term:

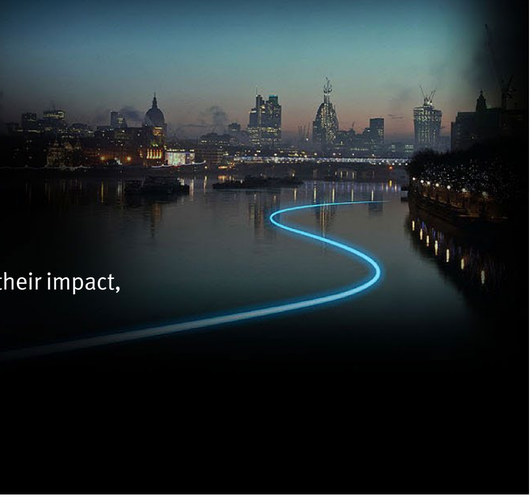
Base oil prices are expected to trend downwards in the year ahead. Based on the global economic outlook, base oil and lubricants demand is expected to remain steady in 2017. Rising crude prices will also provide support to prices. But we expect persistent oversupply in the market to put pressure on prices, especially during periods when seasonal demand is weak. New Group II and bright stock from the Mideast Gulf is expected to start in the third quarter 2017. Rebalancing of the base oil market will require more plant closures or a cut in production run rates. Competition between Group I and Group II refiners will also see the price spread between Group I and II base oils widen and narrow in a cyclical way.

Asia light grade fob export prices *$/t*



See page 12 for more details

Forecast base oil prices												$/t
	Jan 17	Feb 17	Mar 17	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17
US												
SN 150 fob export	483	503	520	539	553	563	571	549	550	537	503	478
SN 500 fob export	520	547	573	598	623	645	666	644	619	584	552	517
Bright stock fob export	699	722	745	760	773	781	784	775	761	742	705	667
N100 fob export	497	522	540	552	551	547	544	522	512	503	484	462
N220 fob export	493	518	536	551	554	553	554	524	518	504	477	447
N600 fob export	730	751	773	793	815	836	855	836	822	801	766	727
4cst domestic	862	868	876	896	921	946	959	944	920	892	881	862
Europe												
SN 150 fob export	570	593	611	621	622	620	619	604	597	583	558	541
SN 500 fob export	619	646	670	682	692	696	696	683	675	647	623	607
Bright stock fob export	774	787	810	822	832	840	841	820	803	787	772	754
4cst fca NWE	708	720	731	744	757	770	783	772	759	738	709	698
Asia												
SN 150 fob export	536	562	587	603	609	611	609	584	559	545	530	516
SN 500 fob export	638	666	687	703	708	708	702	677	648	629	612	602
Bright stock fob export	830	856	879	895	907	909	907	889	863	841	814	796
N150 fob export	540	575	606	629	637	633	622	587	556	537	522	512
N500 fob export	700	735	771	792	797	790	778	754	720	690	677	660
4cst cfr Northeast Asia	677	697	720	737	741	738	733	714	705	697	677	662
4cst cfr India	614	641	663	675	676	674	671	649	639	628	608	594
4cst ex-tank UAE	746	759	776	782	779	773	767	747	724	710	698	686



US

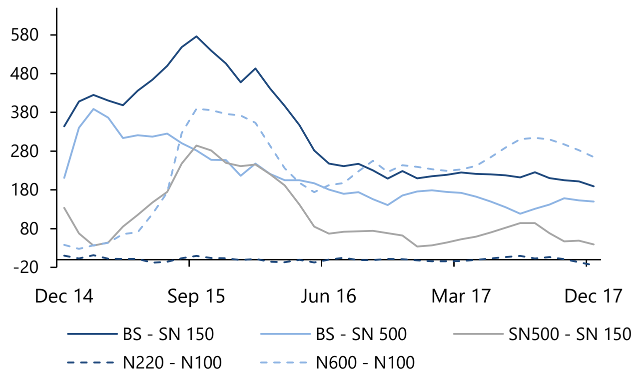
US Group I prices are expected to trend downwards in 2017. This largely reflects the sustained pressure on base oil prices because of oversupply in the market. In the US, new Group II production capacity has far outpaced Group I plant closures. There has been 1.55mn t/yr of Group II production capacity added to the US market in recent years, but only a 510,000 t/yr Group I plant shutdown in the same period. Such a trend coincided with an increase in availability of US Group I base oils for export to other regions.

Prices are projected to trend upwards in the first half of 2017, supported by a pick-up in seasonal demand, rising crude prices and firm buying interest from Africa and Latin America. In the year ahead, US Group I exports are expected to provide strong competition to European Group I exports in these markets. We expect US Group I export prices to be at a discount to European Group I export prices over the next 12 months for all three Group I base oil grades. Such a discount will likely boost the demand for US Group I base oils in these price-sensitive markets. Around 30,000t of US Group I light and heavy base oils moved to west Africa and Latin America in December 2016.

Rising crude prices will provide support to base oils prices in 2017, as refiners seek to raise prices and limit the impact of an increase in feedstock costs. For the year ahead, we expect Opec's November 2016 production agreement to prevent prices from falling back to the very low levels seen previously. But the short-term price elasticity of US tight oil production means that any market upside that might have been associated with strong compliance is effectively capped. Crude is subsequently projected to trade in a $50-60/bl range in the medium term, with Opec still needing to maintain an impressive degree of unity simply to prevent prices from falling again. We expect the balance of risk to be on the downside.

A marginally stronger economic outlook for the year ahead might also have a positive spillover effect on base oils and lubricants demand in the US. The IMF World Economic Outlook, published in October 2016, sees a stronger US economy in 2017 compared with 2016. A prolonged inventory correction cycle and weak business investment has prompted a downward revision of the 2016 growth forecast to 1.6pc. The weakness in capital spending reflects in part still-negative energy investments, dollar appreciation and heightened policy uncertainty related to the electoral cycle. In 2017, growth is expected to pick up to 2.2pc. Firmer domestic demand might curtail supply availability for export and provide support to base oil prices this year.

US intra-grade spreads *$/t*



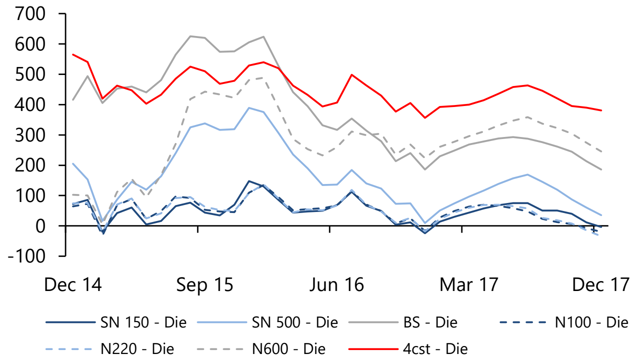
In anticipation of an increase in prices in 2017, some blenders had moved to secure more supplies than they usually would in the last quarter of 2016. Blenders typically run down their inventories in the fourth quarter to avoid paying higher year-end taxes. The move to secure supplies ahead of the peak-demand season in 2017 reflects a preference to pay higher inventory taxes on low-priced supplies. This compares to paying lower inventory taxes and procuring base oils at higher prices in 2017. Such earlier-than-usual stock replenishment will likely limit the expected pick-up in demand in the first half 2017. We subsequently project base oil prices to firm up at a faster pace in the first quarter of 2017, with the momentum slowing nearer to the end of the second quarter 2017.

US Group II prices are expected to trend downwards in the year ahead. The price trend and factors behind those price movements are largely similar those driving the Group I base oils market. But US Group II prices are expected to get further support from Excel Paralubes' scheduled maintenance in the first quarter of 2017. While the plant maintenance is expected to tighten supply and provide support to prices, we do not expect a sharp spike in prices in 2017. A similar Excel Paralubes' maintenance during the peak demand season in the second half of February in 2016 did not yield any sharp increase in prices.

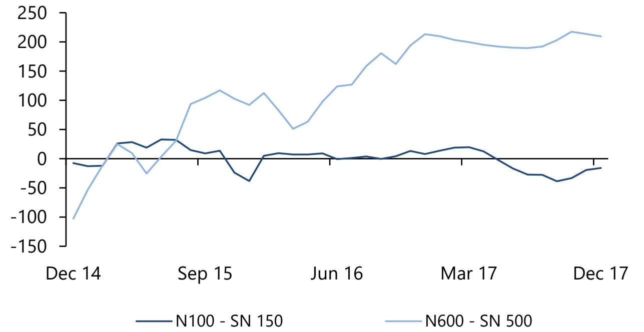
Our analysis suggests a small light-grade premium to diesel might affect light-grades production in the year ahead. The light-grade premium to diesel has been adjusted upwards in the first half of 2017 to reflect higher spot prices in the market. But the premium is still expected to narrow in the second half of 2017 without the support from firm seasonal demand. New Group II production from the Mideast Gulf starting in the third quarter of 2017 will add to the oversupply in the market and put more pressure on global prices. We subsequently project US Group II light-grade prices to be

US

US base oil vs diesel spreads *$/t*



US intra-group spreads *$/t*



at a discount to diesel in the fourth quarter this year. The sustained pressure on US Group II light-grade prices, together with firmer Group III prices, might also encourage US Group II refiners to explore converting some of their Group II production capacity to Group III production instead. While we expect availability of Group II light-grades to be ample in the year ahead, such moves might affect production of Group II light-grades and clear some of the oversupply in the market.

Supply availability of US Group II heavy grades has improved. A major Group II producer lifted its allocation on N600 for its domestic term customers in December last year. A volume restriction was initially in place for Group II heavy grade until the end of 2016. While supply availability of N600 has increased slightly, supply availability of the product for 2017 remains uncertain. Besides the impact of maintenance work, any production yield issues that US Group II producers face with Group II heavy-grade would also impact supply.

US Group III prices are expected to remain steady in 2017. Any price upside is expected to be limited as prices are projected to be under pressure because of the increase in structural supply.

While these new supplies have yet to secure the full set of approvals, their wide discount to approved base oils will likely force sellers of approved Group III base oils to respond with lower prices.

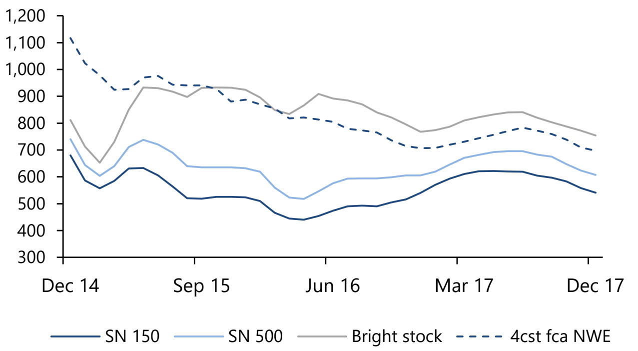
US Group III prices remain the firmest among key regional markets. Relative to crude, US Group III prices are also projected to be firmer than the historical average. While the price-strength ratio relative to crude of 2.17 over the next 12 months is lower than that of 2.51 in 2015, it is still higher than the 1.68 average from 2010-15. Such firm prices and price-strength ratio reflect a slower-than-expected penetration of these new supplies in the US market. Firm US Group III prices will also likely attract more supplies of approved Group III base oils that were displaced from other regions to move to the US market instead. An increase in availability of Group III base oils will put pressure on prices and limit any price upside.

Such unusually firm Group III prices also suggest that there is room for prices to weaken, as and when these supplies manage to secure more approvals and gain higher penetration in the market.

Europe

European Group I prices are expected to trend downwards in 2017 after climbing in the first half of the year. By contrast, the Brent crude price is projected to trend upwards during the same period. Such a difference reflects the sustained pressure on base oil prices due to oversupply in the market. There has been in recent years a mismatch globally between start-up production and plant closures. Global net production rose by 5mn t from 2014 to 2016. Without additional plant closures and run-cuts to clear the supply overhang, prices are expected to be under pressure in the medium term, especially during periods when seasonal demand is weak.

Europe base oil prices *$/t*



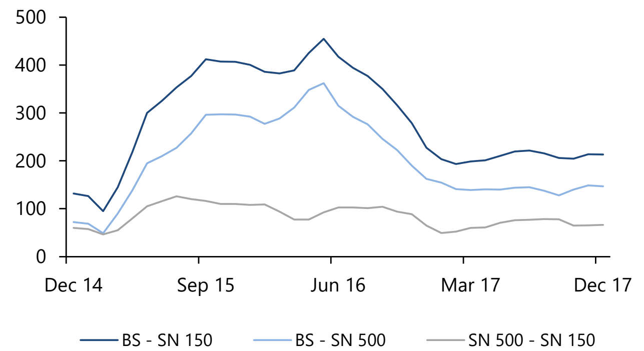
Our analysis suggests that the weak SN 150 premium over gasoil could affect Group I light-grade production in the year ahead. The low average SN 150 premium over diesel indicates that refiners should consider cutting production of SN 150 and boost production of diesel or other base oil grades.

There are signs that such a move has already been taking place. Due to tightening SN 150 availability in the market, the European SN 150 export fob price has risen from $515/t in early November 2016 to $545/t in late December 2016. The SN 150 premium over diesel is subsequently projected to average $111/t over the next 12 months. Such a premium is higher than the $52/t average forecast in the November 2016 base oils outlook issue.

Prices are expected to trend upwards in the first half of 2017, supported by a pick-up in seasonal demand and rising crude prices. The buying pattern in the fourth quarter of 2016 was different from the same period in 2015, providing further support to such price strength.

In the fourth quarter of 2015, European blenders started replenishing their inventories earlier than expected in anticipation of tightening supplies due to Group I plant closures in first half of 2016. Such a move prevented a sharp price spike in first half of 2016.

Europe intra-grade spreads *$/t*



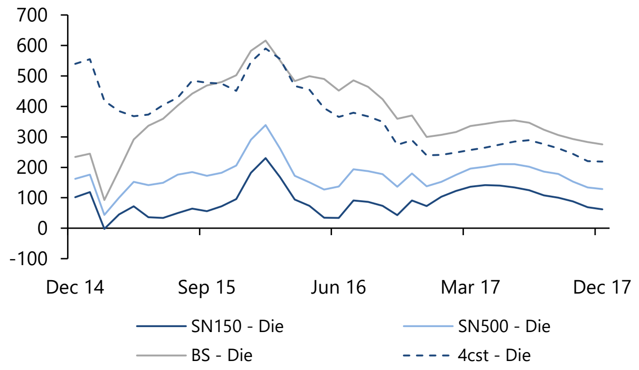
But the lack of such active stock replenishments by blenders in the fourth quarter of 2016 leaves more such stock replenishment to take place ahead of the spring oil-change season in 2017. Firm European demand will also likely limit further any supply availability for export and provide additional support to prices.

But any price-upside is expected to be limited. The economic outlook for the Euro Area is expected to be tepid. According to the IMF World Economic Outlook published in October 2016, the Euro Area is expected to grow at a slightly lower pace in 2016-2017 relative to 2015. Easy monetary policy, low oil prices and a modest fiscal expansion in 2016 will likely support growth. But weaker investor confidence on account of uncertainty following the Brexit vote will weigh on activity. Growth for the whole area is projected to decline slightly to 1.7pc in 2016 and 1.5pc in 2017. In the UK, slower growth is expected due to uncertainty in the aftermath of the Brexit vote. This is expected to weigh on firms' investment and hiring decisions, and consumers' purchase of durable goods and housing. Growth is forecast at 1.8pc in 2016 and 1.1pc in 2017, based on the assumption of smooth post-Brexit negotiations and a limited increase in economic barriers. We expect such trends to have a spillover effect on base oils and lubricants demand in the region.

European Group I prices are also expected to be under pressure in the year ahead due to competition from US Group I refiners for the same international markets that European refiners have been supplying. US Group I export prices are expected to be at a discount to European Group I export prices in throughout 2017. While buying interest from Latin America and Africa is expected to be firm, such a discount will likely boost the attractiveness of US Group I supply in those price-sensitive markets. But any moves by European producers to respond to the price competition will likely result in lower actual prices than currently forecast.

Europe

Europe base oil vs diesel spreads *$/t*



More competitive US export prices also suggest that US Group I supplies are well-suited to cover for any tightness in the European market. Healthy availability of US Group I exports has coincided with the start-up of new Group II production in the US. An increase in Group I supply availability from the US in the European market will put pressure on prices and limit the scope for any sharp price increase.

Firmer crude prices in 2017 will likely support an appreciation of the Russian rouble. A stronger rouble would give Russian blenders more flexibility to import base oils from other regions. Such moves would likely displace some Russian base oils from the country's domestic market, leaving more supplies available for export to other regions. Such a trend would put further pressure on European base oil prices.

We expect more Group II availability this year to also put pressure on European Group II prices, and subsequently demand for Group I base oils. US Group II supply is well-positioned to cover for any base oil supply tightness in the European market. We expect US Group II base oils availability to remain healthy in 2017, especially for light-grades.

New domestic Group II production in China will likely reduce Chinese demand for Group II light-grade imports especially. Any drop in Chinese demand for Group II baes oils is subsequently likely to see Asian producers having more supplies to target regional and international markets. New Group II production in the Mideast Gulf is also well-placed to provide a regular alternative source of Group II supplies for Europe. But it was unclear what portion of those supplies were light-grade base oils and what volume was heavy-grade. It was also unclear what volume would be consumed within the domestic market.

European Group III prices are projected to trend downwards over the next 12 months. The trend largely reflects the impact of an increase in structural supply. The 2017 average monthly forecast of $741/t is subsequently projected to be the lowest in six years.

Without the full-set of OEM approvals, these new supplies are likely to be priced at a steep discount to Group III base oils with approvals. Given the price incentive to maximize consumption of these supplies, producers of approved base oils will have to respond with lower prices to retain market share. Most blenders should have the flexibility to incorporate a certain percentage of unapproved Group III base oils in their formulations, especially with such a price-incentive. This trend will maintain pressure on European Group III prices.

So long as these supplies are competitively priced, blenders will be incentivized to explore various ways to incorporate these new supplies in their formulations. These new supplies could be blended with Group I and Group II base oils to improve the overall quality of those base oils. They could in this way provide an alternative to certain additives and reduce their lubricants blending costs.

Asia

Asia Group I prices are projected to trend downwards in 2017. In the year ahead, the price upside for Asia bright stock prices is expected to be limited because of an increase in structural supply from the US and the Mideast Gulf. New bright stock production from the Mideast Gulf is expected to start by the third quarter this year.

Asia Group I refiners are also expected to face more competition from Group II refiners from the same region this year, especially after the third quarter of 2017 when new Group II production from the Mideast Gulf is expected to start. The Group II base oils premium to Group I base oils is expected to widen gradually in the first half of 2017. Historical analysis suggests that such a premium tends to widen in the first six months of each year. Demand for Group II base oils is usually firmer than demand for Group I base oils during the peak demand season. In the second half of 2017, the Group II base oils premium to Group I base oils is expected to narrow, with N150 projected to be at a marginal discount to SN 150 near the end of 2017.

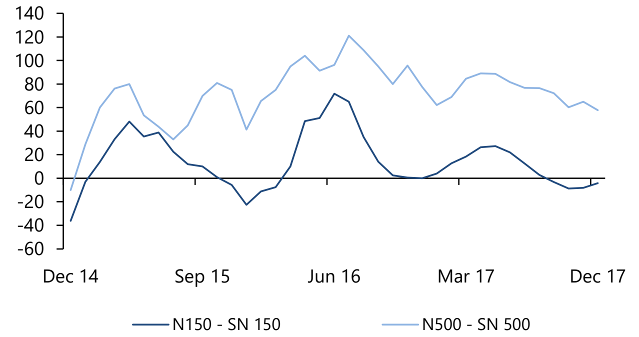
The start-up of new Group II production capacity, together with the withdrawal of seasonal demand, is expected to put sustained pressure on Group II prices. The price spread between Group I and II is likely to widen and narrow in a cyclical way as competition between Group I and Group II refiners in the region intensifies. The changing spread between Group I and Group II prices is largely dictated by the refiners' willingness to respond to price competition to protect market share.

Prices are projected to trend upwards in the first half of 2017, supported by a seasonal pick-up in demand and rising crude prices. Impending changes to the GST structure in India in 2017 might also spur an increase in demand for base oils before its implementation.

There are signs that some buyers have started to replenish stocks ahead of the peak demand season in 2017, especially in China. Base oil imports into China reached 185,000t in October 2016, the second-highest level for the month of October in seven years. The volume is also higher than the 146,000t average for October from 2010 to 2015. Such a trend reflects blenders' confidence that the market has bottomed out and prices will rise in 2017 amid an increase in seasonal demand. Blenders are also keen to avoid the kind of supply tightness and price spike that the market faced in the first half of 2016. Base oil spot prices were subsequently adjusted upwards to reflect the earlier than usual pick-up in seasonal demand. SN 500 and bright stock prices nudged up from the $562/t and $749/t in November 2016 to $603/t and $805/t respectively in December 2016. Group II N150 and N500 prices rose by $31/t and $28/t to $515/t and $687/t respectively in December 2016.

In anticipation of a firmer price outlook in 2017, refiners are also keen to hold on to supplies to take advantage of the higher prices. But we expect this earlier-than-expected stock replenishment to dampen the seasonal increase in demand in 2017. As in the US, we expect prices to firm up at a faster pace in the first quarter of 2017, with the momentum slowing down nearer to the end of the second quartert this year.

Asia intra-group spreads **$/t**



Based on the regional economic outlook, base oil and lubricants demand in Asia is expected to remain steady in the year ahead. According to the IMF World Economic Outlook, published in October 2016, the Chinese economy is expected to grow by 6.6pc in 2016 on the back of policy support. Growth is then expected to slow to 6.2pc in 2017, assuming an absence of further stimulus. But a rise in non-financial debt at an unsustainable pace and the growing misallocation of resources are casting a shadow over the growth outlook. India's GDP is expected to continue to expand at the fastest pace among major economies, with growth forecast at 7.6pc in 2016-17. Positive structural reforms and improved confidence in the economy are expected to support consumer demand and investment. Such robust growth will likely provide support for base oil demand in the region.

Asia Group II prices are expected to trend downwards in 2017. The factors behind those price movements are largely similar to those for Group I base oils. Group II plant maintenance in the first half of 2017 will tighten supply and provide support to prices. But it is unlikely to cause a sharp spike in prices. The expected pressure on Group II prices in 2017 is largely reflective of the mismatch between demand and supply in the region. With new production capacity still to be added

Asia

in 2017, base oil oversupply is expected to worsen in the coming year. Oversupply in the market will likely generate sustained pressure on prices. Any rebalancing of the base oil market will require a drop in global base oil production. This will entail either more closures of Group I or II production or a cut in production run rates. Given the large upfront cost involved in investing in a new base oil plant, a drop in run rates for a prolonged period is unlikely to be sustainable. With prices expected to remain under pressure and volatile in the short term, market participants should be ready to respond to any price signals governed by the mismatched supply-demand dynamics.

Group II base oil oversupply in the region might encourage Asian Group II refiners to target markets such as Europe as an outlet to clear some of the supply overhang. As has been the case in recent years, base oil oversupply in the region might also prompt refiners to undergo more impromptu plant maintenance. Such maintenance will narrow the supply-demand gap temporarily by tightening supplies when it takes place.

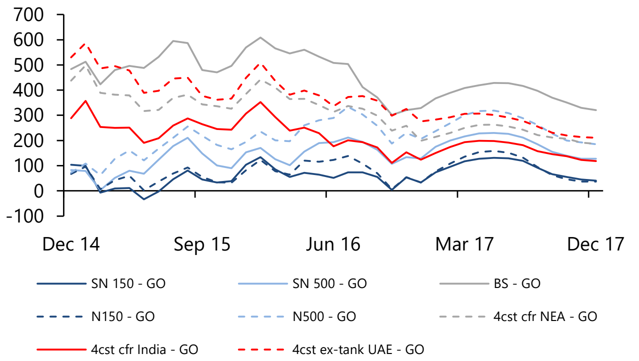
Group III prices are projected to trend downwards over the next 12 months. But the price-strength ratio relative to crude is still expected to be higher than the historical average.

The price-strength ratios are lower than the historical high in 2015, but remain firmer than the historical average. The northeast Asia 4cst price strength ratio in 2017 is expected to be 1.82, higher than the 1.26 average from 2010-14. In India, the price-strength ratio of the 4cst price in 2017 is projected at 1.66. As in China, this is firmer than the historical average of 1.21 from 2010-14.

As such a price-strength ratio divides the base oil price over the crude price, comparing the ratio across time has already taken the crude price factor into consideration. With the crude price factor accounted for, it is counter-intuitive to expect Group III prices in the year ahead to be firmer than the historical average, especially in view of the increase in structural supply. Considering that these new supplies have gained the highest penetration in Asia, it is even more counter-intuitive to see such firmer-than-average price-strength ratios.

A growing issue for Asian Group III producers remains how to compete with these new Group III supplies in the market. Some producers of approved Group III base oils have already responded with lower prices. While improved specification

Asia base oil vs gasoil spreads ***$/t***



requirements in lubricant formulations will eventually see greater Group III usage globally, such a switch will likely be gradual. Oversupply in the interim period still requires a strategic response.

One option is to differentiate further the products being offered. One Group III producer had adjusted its Group III production to make Group III+ base oils instead. Another option would be to engage in price competition and protect market share. The emergence of these new supplies has put pressure on both Group II and Group III light-grade prices in India. Producers could also consider targeting more lucrative markets such as Europe and the US. Another option is for producers to enter or expand their lubricants blending business. Such a move utilises those excess base oils and acts as a natural hedge against falling base oil prices.

Maintenance and shutdowns

Upcoming / recent base oil plant maintenance / shutdowns / closures

Refiner	Location	Timing	Capacity	Capacity affected	Cause
JX Nippon	Mizushima A, Japan	Mid-Sep 2017 for 2 months	180,000 t/yr	All	Maintenance
Cosmo	Yokkaichi, Japan	June 2017 for 2 months	350,000 t/yr	All	Maintenance
JX Nippon	Mizushima B, Japan	1H May to end-Aug 2017	225,000 t/yr	All	Maintenance
Excel Paralubes	Westlake, Louisiana, US	Mar 2017	22,000 b/d	NA	Maintenance
Sinopec	Jinan, China	Feb 2017 for 1 month	150,000 t/yr	110,000 t/yr	Maintenance
IRPC	Rayong, Thailand	Feb 2017 for 45 days	320,000 t/yr	All	Maintenance
BPCL	Mumbai, India	Early Jan 2017 for 2 months	180,000 t/yr	All	Maintenance
Gazpromneft	Omsk, Russia	Jan 2017 for 3 months	230,000 t/yr	All	Maintenance
Sinopec	Jingmen, China	15 Dec 2016 for 30-40 days	400,000 t/yr	200,000 t/yr	Maintenance
Avista Oil	Peachtree, Georgia, US	End-Nov 2016 for 4-5 days	1,250 b/d	All	Maintenance
Vertex Energy	Columbus, Ohio, US	Mid-Nov 2016 for 1 week	1,500 b/d	All	Maintenance
HCC	Indianapolis, Indiana, US	Nov 7 2016 for 3-4 days	2,500 b/d	All	Maintenance
HPCL	Mumbai, India	28 Nov 2016 for 45 days	480,000 t/yr	225,000 t/yr	Maintenance
Chevron	Richmond, California, US	End-Sep 2016 for 50-55 days	1,020,000 t/yr	NA	Maintenance
S-Oil	Onsan, South Korea	20 Oct 2016 for 30-40 days	41,000 b/d	28,000 b/d	Maintenance
Sepahan	Isfahan, Iran	1H Oct 2016 for 3-4 weeks	485,000 t/yr	Partial	Maintenance
Pemex	Salamanca, Mexico	Oct 11 2016 for 3-4 weeks	6,000 b/d	All	Maintenance
Naftan	Novopolotsk, Belarus	Oct 5 2016 for 1 month	200,000 t/yr	All	Maintenance
Lotos	Gdansk, Poland	Oct 2016	245,000 t/yr	NA	Maintenance
Shell	Pulau Bukom, Singapore	End-Sep 2016	380,000 t/yr	All	Maintenance
Eni	Livorno, Italy	End-Sep 2016 for 50 days	645,000 t/yr	All	Maintenance
Gazpromneft	Omsk, Russia	Sep 2016	230,000 t/yr	Partial	Maintenance
Rosneft	Angarsk, Russia	5 Sep 2016 for 4 weeks	250,000 t/yr	All	Maintenance
JX Nippon	Negishi, Japan	Sep 20 2016 for 2 months	210,000 t/yr	All	Maintenance
Sinopec	Shanghai, China	1H Sep 2016 for 2 weeks	600,000 t/yr	All	Maintenance
Petrochina	Daqing, China	Mid-Aug 2016 for 1 month	275,000 t/yr	NA	Maintenance
Thai Lube	Siracha, Thailand	2H Aug 2016 for 1 month	275,000 t/yr	NA	Maintenance
Calumet	Princeton, Louisiana, US	2H Aug 2016 for 2 weeks	6,900 b/d	Partial	Maintenance
Iranol	Tehran, Iran	Aug-Sep 2016	225,000 t/yr	All	Maintenance
Ergon Refining	Vicksburg, Mississippi, US	Aug 2016 for 4 weeks	25,000 b/d	Partial	Maintenance
Pertamina	Cilacap, Indonesia	End-Jul 2016 for 20-25 days	440,000 t/yr	All	Maintenance
HCC	Indianapolis, Indiana, US	Mid-Jul for 1 week	2,500 b/d	All	Maintenance
Bazan Group	Haifa, Israel	End-Jul to 2H Sep 2016	75,000 t/yr	All	Maintenance
Sinopec	Jingmen, China	1H Jul 2016 for 20 days	400,000 t/yr	150,000 t/yr	Maintenance
Sinopec	Shanghai, China	1H Jul 2016 for 35 days	600,000 t/yr	300,000 t/yr	Maintenance
MOL	Szazhalombatta, Hungary	Jul 2016 for 4 weeks	150,000 t/yr	All	Maintenance
Sinopec	Shanghai, China	2H Jun 2016 for 1 month	600,000 t/yr	300,000 t/yr	Maintenance
SK Lubricants	Ulsan, South Korea	Late Jun to mid-Jul 2016	300,000 t/yr	All	Maintenance
Formosa	Mailiao, Taiwan	2H Jun to 20 Aug 2016	520,000 t/yr	All	Maintenance
Avista Oil	Peachtree, Georgia, US	2H Jun 2016 for 1 week	1,250 b/d	All	Maintenance
Excel Paralubes	Westlake, Louisiana, US	2H Jun 2016	22,000 b/d	Partial	Maintenance
JX Nippon	Mizushima B, Japan	Mid-Jun for 2 months	225,000 t/yr	All	Maintenance
Shandong Hengrunde	Shandong, China	2H May 2016 for 30 days	150,000 t/yr	All	Maintenance
Panjin Northern	Liaoning, China	15 May 2016 for 20-30 days	400,000 t/yr	NA	Maintenance
San Joaquin Ref	Bakersfield, California, US	Early May 2016 for 3 weeks	8,100 b/d	NA	Maintenance
Sapref	Durban, South Africa	May 2016	170,000 t/yr	All	Maintenance
Repsol	Cartagena, Spain	Apr 2016	135,000 t/yr	NA	Maintenance
Lukoil	Perm, Russia	Apr 2016 for 45 days	460,000 t/yr	NA	Maintenance

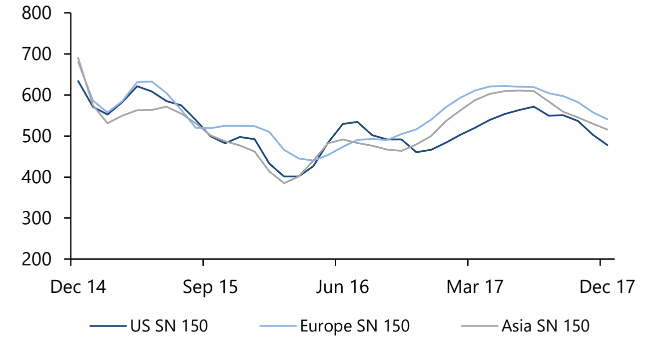
Every effort has been made to verify information directly with appropriate company sources. Some information has been obtained from usually reliable sources, but cannot be officially confirmed with the refinery concerned. The list will be updated when new information becomes available.

New Plant Capacity

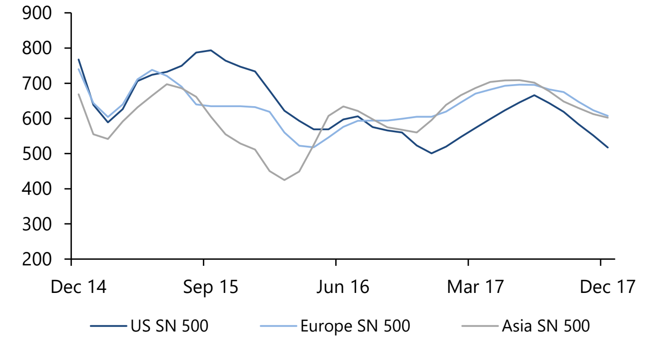
Upcoming / recent expansions / conversions / new plants					
Refiner	**Location**	**Timing**	**New capacity**	**Grade**	**Expansion / new plant**
Sasol	Louisiana, US	After 2020	NA	GTL	New
Modrica refinery	Modrica, Bosnia	NA	200,000 t/yr	Group III	Expansion
Hengli Petrochemical	Dalian, China	2018	683,000t/yr	Group II and III	New
Pemex	Salamanca, Mexico	2018	3,300 b/d	Group II	Delayed
ExxonMobil	Rotterdam, Netherlands	2018	NA	Group II	New
Holly Frontier	Wood Cross, US	2018	10,000-12,000 b/d	Group III	Delayed
Luberef	Yanbu, Saudi Arabia	3Q 2017	715,000 t/yr	Group II	New
Petrobras	Comperj, Brazil	2017	355,000 t/yr	Group II	Cancelled
Neste	NA	By 2017	200,000 t/yr	Group III	Expansion
Hainan Handi	Hainan, China	End-2017	500,000 t/yr	Group II+/III	New
Slavneft	Yaroslavl, Russia	1Q 2017	100,000 t/yr	Grp III	New
S-Oil	Onsan, South Korea	Dec 2016	3,780 b/d	Grp II	Expansion
Panjin Northern Asphalt	Liaoning, China	Oct 2016	300,000 t/yr	Naphthenic base oils	New
CNOOC	Taizhou, China	Oct 2016	600,000 t/yr	Group II	New
VN Oil	Hiep Phuoc, Vietnam	3Q 2016	50,000 t/yr	Group II re-refinery	New
Ergon Refining	Vicksburg, US	3Q 2016	3,000 b/d	Group I bright stock	New
Adnoc	Abu Dhabi, UAE	Apr 2016	620,000 t/yr	500,000 t/yr Group III, 120,000 t/yr Group II	New
Shandong Qingyuan	Shandong,China	Jun 2016	600,000 t/yr	Group II	New
Jinling Petrochemical	Nanjing, China	Mar 2016	200,000 t/yr	Group II	New
Sinopec	Maoming, China	Jun 2016	400,000 t/yr	Group II+, Group III	Expansion
ExxonMobil	Singapore	1Q 2015	300,000 t/yr	Group II	Expansion
ExxonMobil	Baytown, US	1Q 2015	300,000 t/yr	Group II	Expansion
NIS, Serbia	Serbia	2015	180,000 t/yr	Group II/ naphthenic	Cancelled
Nynas	Harburg, Germany	2015	NA	350,000 t/yr naphthenic base oils	Conversion/expansion
Sinopec	Yanshan, China	2015	240,000 t/yr	Group II	Expansion
Tatneft	Nizhnekamsk, Russia	Dec 2014	186,000t /yr	Group II/III	New
SK Lubricants/Repsol	Cartagena, Spain	20 Sep 2014	630,000 t/yr	Group III 3-8cst	New
Shell/Hyundai Oilbank	Daesan, South Korea	Aug-Sep 2014	650,000 t/yr	Group II	New
Hengrunde Petrochemical	Shandong,China	Aug 2014	200,000 t/yr	Group II	New
Heritage-Crystal Clean	Indiana, US	Mid-2014	25mn USG/yr	Re-refined Group II light and mid-grade	Expansion
Naftan	Novopolotsk, Belarus	May 2014	72,000 t/yr	Group I	Conversion
Chevron	Pascagoula, US	July-Aug 2014	1.25mn t/yr	Group II	New
Southern Oil	Queensland, Australia	Mar 2014	100mn l/yr	NA	New
Puralube	Troeglitz, Germany	2014	50,000 t/yr	Group II	New
Hebei Feitian Petrochemical	Hebei, China	Q4 2013	100,000 t/yr	Group II	New
Shandong Qingyuan	Shandong, China	Early 2014	300,000 t/yr	Group I+	New
Panjin Northern Asphalt	Liaoning, China	Oct 2013	400,000 t/yr	Group II	Expansion
S-Oil	Onsan, South Korea	Oct 2013	3,000 b/d	Group III	Expansion
SK Lubricants	Ulsan, South Korea	Jun 2013	11,000 b/d	Group II heavy-grade, from Group III	Conversion
Avista Oil (US)	Peachtree, Georgia, US	May 2013	1,000 b/d	Group II	New
Lwart	Lencois Paulista, Brazil	Jan 2013	150,000 t/yr	Group II re-refinery	New
Naftan	Novopolotsk, Belarus	Nov 2012	NA	Add 6,000 t/month Group III	Conversion
Sinopec	Jinan, China	4Q 2012	50,000 t/yr	Group II and BS, from 100,000 t/yr Group I	Conversion/expansion
SK Lubricants/JX Energy	Ulsan, South Korea	May 2012	26,000 b/d	Group III	New
Heritage-Crystal Clean	Indiana, US	1Q 2012	30mn USG/yr	Re-refined Group II light grade	New
Lotos	Gdansk, Poland	2H 2012	NA	Add Group II	Conversion
PetroChina	Fushun, China	3Q 2011	NA	Only heavy-grade Group I	Conversion
GS Caltex	Yeosu, S. Korea	Jun 2011	3,000 b/d	Heavy-grade Group II	Expansion

Every effort has been made to verify information directly with appropriate company sources. The list will be updated when new information becomes available.

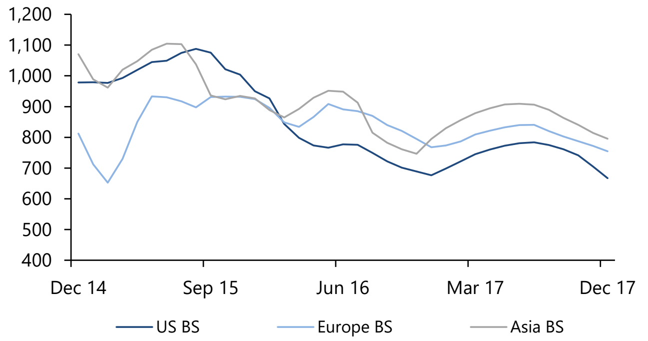
Group I SN 150 fob export $/t



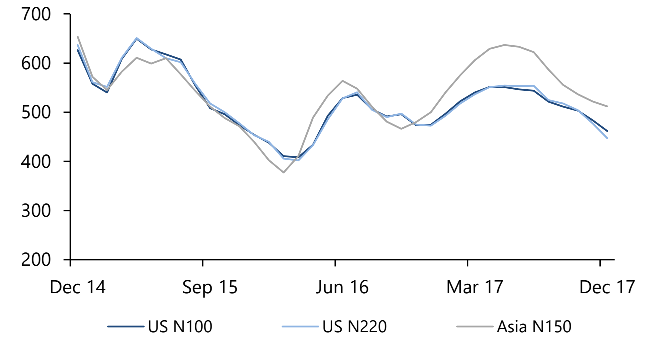
Group I SN 500 fob export $/t



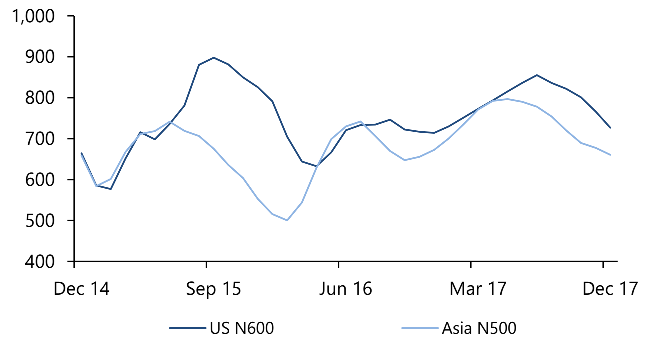
Group I bright stock fob export $/t



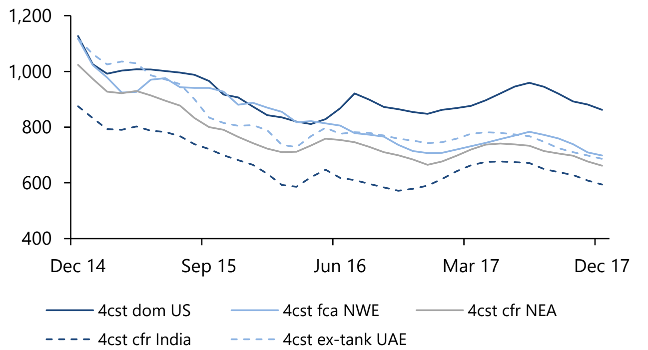
Group II N100 & N150 fob export $/t



Group II N500 & N600 fob export $/t



Group III 4cst $/t



Argus *Base Oils Preview 2017* is published by Argus Consulting Services, a division of Argus Media Group.

Registered office
Argus House, 175 St John St, London, EC1V 4LW
Tel: +44 20 7780 4200 Fax: +44 870 868 4338
email: sales@argusmedia.com

ISSN: 2059-8017

Publisher:
Adrian Binks

Global compliance officer:
Jeffrey Amos

SVP Consulting Services:
Philip Shaw

Head of forecasting:
Francis Osborne

Senior Analyst:
Alvin Chew
Tel: +65 6496 9923
alvin.chew@argusmedia.com

Customer support and sales
Technical queries
technicalsupport@argusmedia.com
All other queries
support@argusmedia.com

London, UK Tel: +44 20 7780 4200
Astana, Kazakhstan Tel: +7 7172 54 04 60
Beijing, China Tel: + 86 10 6515 6512
Dubai Tel: +971 4434 5112
Moscow, Russia Tel: +7 495 933 7571
Rio de Janeiro, Brazil Tel:+55 21 3514 1402
Singapore Tel: +65 6496 9966
Tokyo, Japan Tel: +81 3 3561 1805
Houston, US Tel:+1 713 968 0000
New York, US Tel: +1 646 376 6130

INVESTORS IN PEOPLE

Argus Base Oils Services

About Argus

Argus is the leading independent agency for price reporting, news and analysis for base oils, as well as international energy, petrochemicals, fertilizer and metals markets.
Argus prices are used by market participants as indexes in physical contracts and as benchmarks in derivatives contracts.

Our services

- **Argus Base Oils Outlook**

  A short-term forecast of key base oils prices spanning 12 months into the future.

- **Argus Base Oils**

  Market reporting on spot and posted prices and analysis of the global base oils market.

- **Consulting**

  Tailor-made research for clients seeking the highest quality data, analysis, ins commentary on the international base oils market.

Argus Base Oils Outlook

Overview

Argus Base Oils Outlook, published monthly, uses a proprietary short-term model to forecast future prices by identifying and quantifying the relationships between a set of price determinant variables. It taps Argus coverage and data of the global base oils spot market and fundamentals to facilitate the analysis of its forecasts.

Each base oils price forecast uses a different model. This captures the unique price dynamics of each group/grade of base oil with their most appropriate and influential price determinants.

Key Determinants

- **Historical prices**
  Historical base oil prices capture the latest "price formation" dynamics in the market. This provides a good indicator of how prices are going to behave in the near term and incorporates factors such as seasonality.

- **Supply schedule**
  Short-term supply shocks like planned or unplanned shutdowns or temporary increases in run-rates can have a profound impact on short-term prices. Argus uses its extensive global market-feedback channels and research-coverage to maintain an up-to-date base oil supply database at country, plant and viscosity level.

- **Crude, gasoil, diesel prices and crack spreads**
  Relevant crudes prices, and oil products like vacuum gasoil and diesel, have an impact on base oil prices. Argus incorporates this determinant using its extensive database of global spot crude and oil product prices.

Key Features

- **Facilitates short-term planning/budgeting**
- **Reduces exposure to spot-market volatility**
- **Provides a third-party reference-price to measure against internal price-targets**

Argus Base Oils

Overview

Argus Base Oils provides weekly base oils spot prices, posted prices, and market analysis for all the key markets globally as well as valuable price analytics information on base oil premiums to VGO, crude, and gasoil. Argus Base Oils is the only market service to capture the full spectrum of base oils trade in the international market in a single report.

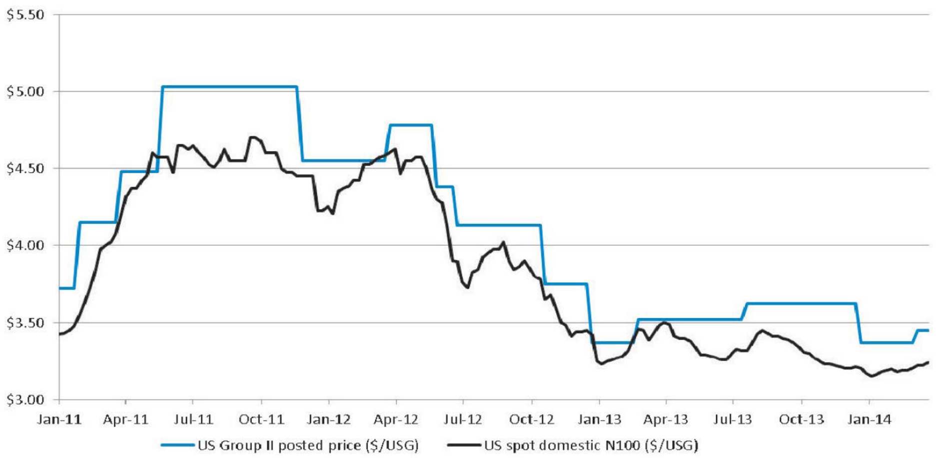
Key Features

- Weekly market spot price assessments and analysis for Group I, II, and III base oils in key global markets
- Daily market-moving news
- Historical data
- Transparent market-appropriate methodology
- Daily updates of forward curves and profit margins for base oils production
- Detailed economics and profitability data and analysis from a global leader in petroleum indexation

Spot vs posted prices

Argus believes in robust and accurate spot prices as the best way for an open market to work efficiently. A spot price is an open-market price negotiated between buyers and sellers. Prices that flat-line, or change infrequently, lag the market. In today's market, lagging prices can send inappropriate signals.

- Lagging prices send inappropriate signals to buyers and sellers alike, exacerbating market risk
- Lagging prices "freeze" the market, when they do not change for an extended period
- Lagging prices "freeze" liquidity, exacerbating peaks and troughs



Contact us for more information about Argus Base Oils Services:

info@argusmedia.com

+44 (0) 20 7780 4200

www.argusmedia.com/Oil-Products

Consulting

Overview

With a wealth of knowledge and experience in the base oils markets globally, Argus provides clients with tailored researched, data, benchmarking, modelling, strategic analysis and decision-making support. Given Argus' pedigree in reporting on the base oil trade, the research is firmly focused on markets and will give clients a real competitive advantage.

Services provided

- **Strategic planning**
  Support organisations in defining their market strategies, helping them to assess options for entry, exit, further investment or changes in focus.
- **Supply, demand and pricing analysis**
  Analysis of fundamentals and/or pricing, to help clients evaluate how and where they might operate or to assess the positions of their competitors.
- **Market supply strategy**
  Assessment of the ability to supply commodities to, or from, a market, and the costs of doing so.
- **Policies and regulations**
  Review of regulations affecting a market and assessment of the layers of impact.
- **Forecasts and outlooks**
  Short, medium and long-term forecasts and outlooks for supply and demand, trade, costs and prices.
- **Valuation models**
  Including new projects, mergers, acquisitions and existing asset assessments.
- **Project feasibility**
  Studies to evaluate and analyse project potential.
- **Presentations and trainings**
  Deliver presentations and run client seminars on relevant topics.

Customers

We have conducted research for a range of clients, including some of the biggest names in the industry.

Oil and Gas
- BP
- CNOOC
- ExxonMobil
- JX Nippon Oil & Energy
- Luberef
- Petronas
- Pertamina
- Philips 66
- Saudi Aramco
- Shell
- SK Energy

Coal
- Kaltim Nusantara Coal
- Masinloc Power Partners
- Hong Kong Electric
- Foresight Energy
- Toyo Thai Power

Fertilizers
- Allana Potash
- Arab Potash
- FertiEuropa
- Potash Corp of Saskatchewan
- Sojitz

Petrochemicals
- Huntsman
- Polytama Propindo
- Royal Chemie Indonesia
- SK Global Chemicals
- Jurong Aromatics
- BASF

Others
- Forest First
- Itochu
- Mitsubishi Heavy Industries
- Petrixo
- Vale
- Vitol

Speak to our consultants at:

consulting@argusmedia.com
+20 (0) 20 7780 4200
www.argusmedia.com/consulting

Argus Media Group

Argus House, 175 St John Street, London EC1v 4LW, United Kingdom
Tel: +44 (0) 20 7780 4200 | Email: info@argusmedia.com | Web: argusmedia.com

illuminating the markets