

# Country Report

## From

# K O R E A



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## I . Country Report

### Korea Petrochemical Current Status and Prospects

#### 1. Korean Economy's Current Status and Prospects

- In 2016, Korea gross domestic production (GDP) grew by 2.5%, a 0.2%p decrease from the previous year. Domestic demands made a rebound underpinned by favorable conditions in the construction industry, but growth of exports blunted due to the slowdown of the Chinese economy and the downturn trend in oil prices.
- This year, the Korean economy is showing signs of moderate recovery, for example increases in employment and industrial production, with lower oil prices contributing to stable commodity prices. There are an increasing number of signs indicative of economic recovery include the rebound of equipment investment and stock markets, although the politics issues.
- However, there are uncertainties in overseas, including, the protective trade and Chinese economy growth rate. With unlikely skyrockets in domestic consumption and continued slowdown of exports, this year the Korean economy is expected to grow in the similar pace as the previous year, falling short of the government's forecast of 2.5%.

< Key indicators of the Korean economy and forecasts (Unit: %) >

	2016		2017		2018	
	Annual	1st half	2nd half	Annual	Annual	Annual
GDP	2.7	2.4	2.6	2.5	2.8	2.8
Private consumption	2.4	1.9	1.9	1.9	2.3	2.3
Equipment investment	-2.6	3.0	2.0	2.5	3.6	3.6
Construction investment	10.9	5.9	3.0	4.3	0.1	0.1
Commodity exports	0.9	2.9	2.0	2.4	2.8	2.8

Source: Bank of Korea (January 2017).

## 2. Petrochemical Industry's Status and Prospects

### [2016 Status]

- In 2016, production and demand in the three key areas of the petrochemical industry (synthetic resin, synthetic fiber raw materials, and synthetic rubber) were increased by front industries, whereas export and import marked of decrease.
- Despite the recovery of increased production and domestic demands in synthetic resins, the production volume was 20,931 KT, a year on year (YoY) decrease of 0.3%, due to dull productions in synthetic fiber raw materials and synthetic rubber.
- Exports were 10,773 KT, marking a 5.8% YoY decrease due to enhanced self-reliance in China that is the biggest export market and worsened global oversupply of synthetic fiber raw materials and synthetic rubber.
- Demands increased to 11,077 KT, an 5.2% YoY increase, underpinned by strong increases in synthetic resin demands from some front industries such as construction.
- The rate of operation of domestic petrochemical industry(based on 3 major fields) decreased to 86.5%, a 0.8%p YoY decrease, affected by sluggishness in synthetic fiber raw materials and synthetic rubber. The synthetic resin industry enjoyed higher profitability, and its operation rate remained high at 94.1%, a 0.9%p YoY increase. Synthetic fiber raw materials experienced a 3.5%p YoY decrease in the operation rate, 76.3%, due to decreased exports to the Chinese market, and the operation rate of the synthetic rubber industry was down to 72.4% affected by global oversupply and sluggish production in forward industries, marking a 0.7%p YoY decrease.

\* Operation rate of the three major fields (%): 87.3 (2015) 86.5 (2016) (0.8%p )

### <Supply and demand of major petrochemical products>

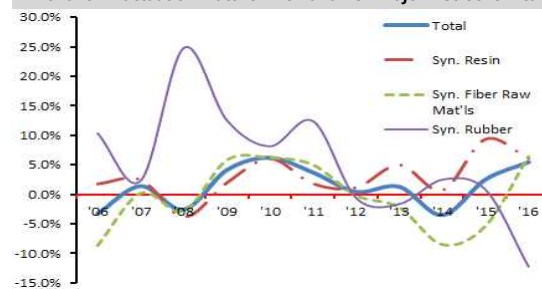
(Unit: 1,000 tons)

	2016						2017						
	1H		2H		Total	G.R.	1H		2H		Total	G.R.	
	Pro	G.R.	Pro	G.R.			Pro	G.R.	Pro	G.R.			
Syn. Resin	Pro	6,742	3.5%	6,653	1.2%	13,394	2.3%	6,752	0.2%	6,945	4.4%	13,697	2.3%
	Exp	3,886	2.4%	3,727	-3.2%	7,612	-0.4%	3,895	0.2%	3,814	2.3%	7,709	1.3%
	Imp	196	3.7%	194	6.7%	390	5.2%	189	-3.6%	198	2.2%	387	-0.7%
Syn. Fiber Raw Mat'ls	Pro	3,052	4.9%	3,120	7.3%	6,172	6.1%	3,046	-0.2%	3,329	6.7%	6,375	3.3%
	Exp	3,301	-7.7%	3,344	-0.2%	6,645	-4.1%	3,421	3.6%	3,344	0.0%	6,765	1.8%
	Imp	1,342	-20.1%	1,231	-17.2%	2,573	-18.8%	1,250	-6.8%	1,243	1.0%	2,493	-3.1%
Syn. Rubber	Pro	216	-19.8%	232	-4.5%	448	-12.6%	210	-2.9%	215	-7.2%	425	-5.1%
	Exp	2,176	0.3%	2,344	11.4%	4,520	5.8%	2,381	9.4%	2,315	-1.2%	4,696	3.9%
	Imp	451	-11.1%	442	-6.3%	893	-8.8%	435	-3.5%	489	10.8%	924	3.6%
Total	Pro	299	-7.2%	289	-6.0%	588	-6.6%	285	-4.7%	325	12.6%	610	3.8%
	Exp	39	-12.2%	41	-9.0%	80	-10.6%	45	13.9%	34	-16.2%	79	-1.5%
	Imp	191	-16.7%	194	-7.4%	385	-12.2%	195	1.9%	199	2.4%	393	2.2%
Total	Pro	10,493	-1.0%	10,438	0.4%	20,931	-0.3%	10,608	1.1%	10,778	3.3%	21,386	2.2%
	Exp	5,526	-4.7%	5,247	-7.0%	10,773	-5.8%	5,430	-1.7%	5,383	2.6%	10,813	0.4%
	Imp	452	-10.3%	467	-0.6%	918	-5.6%	444	-1.7%	448	-4.1%	891	-2.9%
Total	Pro	5,419	2.1%	5,658	8.3%	11,077	5.2%	5,622	3.7%	5,843	3.3%	11,465	3.5%

Data: KPIA

Note: Production is based on sales

### <Trend of Fluctuation Rate of Demand for Major Petrochemicals>



Data: KPIA

### [Prospect of 2017]

- In 2017, the petrochemical industry is expected to enjoy increases in productions and demands underpinned by favorable conditions in its front industries and improved export market conditions.
- Productions** are expected to reach 21,386 KT, a 2.2% YoY increase, due to slight equipment increases, for example KPIC and reduced NCC turn around (T/A) works. In particular, synthetic resin and rubber productions are expected to enjoy a slight rise.
- Exports** are expected to reach 10,813 KT, a 0.4% YoY increase, due to positive factors such as the landing of China's economic slowdown and favorable conditions for the US economy.
- Demands** are expected to reach 11,465 KT, a 3.5% YoY increase. Increased production and investment in the construction industry will lead to a boom in synthetic resin productions.

### <Status and Prospect of Demand and Supply of Major Petrochemicals>

(Unit: 1,000 tons)

		'10	'15	'16	G.R.	'17 <sup>F</sup>	G.R.	AAGR ('10-'17)
Syn. Resin	Production	11,727	13,090	13,394	2.3%	13,697	2.3%	2.2%
	Imports	190	371	390	5.2%	387	-0.7%	10.7%
	Sub-Total	11,917	13,461	13,784	2.4%	14,084	2.2%	2.4%
	Exports	6,958	7,643	7,612	-0.4%	7,709	1.3%	1.5%
	Domestic Demand self-effic. (%)	4,960	5,817	6,172	6.1%	6,375	3.3%	3.7%
Syn. Fiber Raw Mat'ls	Production	8,582	6,928	6,645	-4.1%	6,765	1.8%	-3.3%
	Imports	591	512	448	-12.6%	425	-5.1%	-4.6%
	Sub-Total	9,172	7,440	7,121	-4.3%	7,190	1.0%	-3.4%
	Exports	4,312	3,166	2,573	-18.8%	2,493	-3.1%	-7.5%
	Domestic Demand self-effic. (%)	4,860	4,274	4,520	5.8%	4,696	3.9%	-0.5%
Syn. Rubber	Production	878	978	893	-8.8%	924	3.6%	0.7%
	Imports	71	90	80	-10.6%	79	-1.5%	1.5%
	Sub-Total	949	1,068	973	-8.9%	1,003	3.1%	0.8%
	Exports	552	630	588	-6.6%	610	3.8%	1.4%
	Domestic Demand self-effic. (%)	398	439	385	-12.2%	393	2.2%	-0.2%
Total	Production	21,186	20,996	20,931	-0.3%	21,386	2.2%	0.1%
	Imports	852	973	918	-5.6%	891	-2.9%	0.6%
	Sub-Total	22,038	21,969	21,878	-0.4%	22,277	1.6%	0.1%
	Exports	11,821	11,439	10,773	-5.8%	10,813	0.4%	-1.3%
	Domestic Demand self-effic. (%)	10,217	10,529	11,077	5.2%	11,465	3.5%	1.7%

Data: KPIA

□ Trend of Supply and Demand for Each Field

(1) Synthetic resin

[Status of 2016]

- In 2016, the synthetic resin industry in Korea marked increases in production and demand underpinned by construction investment.
  - **Productions** were 13,394 KT, a 2.3% YoY increase, thanks to increased productions following ABS equipment expansions, improved export market conditions, and favorable conditions in the appliances and automotive industries. In particular, ABS enjoyed a high, 9.2% YoY increase underpinned by equipment expansions.
  - **Exports** decreased to 7,612T, a 0.4% YoY decrease. HDPE, PVC, and EPS marked significant decreases, whereas ABS exports increased by 8.5%, respectively, compared to the previous year. Synthetic resin exports to China accounted for 33.9% of the total exports with a 0.3%p YoY decrease. Exports to Vietnam made a sudden rise of 11.8%. Exports to Malaysia and Indonesia increased 23.8%, 21.2% YoY too.
  - **Demands** reached 6,172 KT, a 6.1% YoY increase, favored by growth of construction material demands following the booming construction industry, amendments to the construction regulations.

[Prospect of 2017]

- In 2017, Korean synthetic resin industry is expected to do well all in productions, demands and exports, favored by the landing of China's demand, growth led by advanced economies, and stronger cost competitiveness underpinned by low oil prices.
  - **Productions** are expected to reach 13,697 KT, a 2.3% YoY increase, thanks to increases in small production facilities, reductions in NCC T/A, and an improved operation rate following predictions for the tight ethylene supply and demand in Asia.
  - **Exports** are expected to reach 7,709 KT, a 1.3% YoY increase, led by increases in PE, PP, ABS exports owing to stronger export competitiveness following declines in raw material prices (naphtha, etc.) affected by the low oil price.
  - **Demands** are expected to be 6,375 KT, a 3.3% YoY increase, thanks to the expected increases in construction materials demands following the continued upturn in the nation's construction market.

**<Status of Synthetic Resin Demands and Supply>** (Unit: 1,000 tons)

		2015		2016				2017	
		Total		1H		2H		Total	
			G.R		G.R		G.R		G.R
Syn. Resin	Pro	13,024	3.8%	6,742	3.5%	6,653	1.2%	13,394	2.3%
	Exp	7,651	1.0%	3,886	2.4%	3,727	-3.2%	7,612	-0.4%
	Imp	371	4.8%	196	3.7%	194	6.7%	390	5.2%
	Dem	5,745	8.0%	3,052	4.9%	3,120	7.3%	6,172	6.1%

Data: KPIA  
Note: Production is based on sales

(2) Synthetic Fiber Raw Materials

[Status of 2016]

- In 2016, Korean synthetic fiber raw material productions made a 4.1% YoY decrease to 6,645 KT, although the demands increased by 5.8% compared to the previous year, 4,520 KT.
  - **Productions** marked a 4.1% YoY decrease, 6,645 KT, due to a decline in the operation rate affected by China's stronger self-reliance in TPA. But DMT productions increased owing to the completion of SK Petrochemical's 60 KT expansion project at the June of 2016 and growth of the local market, respectively.
  - **Exports** decreased by 18.8% compared to the previous year, 2,573KT. Continued declines were observed in the TPA which is suffering from oversupplies in China.
    - Exports of synthetic fiber raw materials to China decreased by 31.3% compared to the previous year, 756 KT. In particular, TPA exports experienced severe sluggishness including continued declines in the Chinese market, which surrendered its position as the biggest export market to Lithuania.
    - Upon the anti-dumping regulation against TPA, exports to China and India decreased by 73.2%, 52.8% to the previous year.
  - **Demands** decreased to 4,520 KT, a 5.8% YoY increase affected by downturns in the front industries.

[Prospect of 2017]

- In 2017, the synthetic fiber raw material industry is expected to rise in productions and demands.
  - **Productions** are expected to increase to 6,765 KT, marking a 1.8% YoY increase because of base effect by TPA, and expansion project of DMT. CPLM market will be improved than previous year.
  - **Exports** are expected to be 2,493 KT, a 3.1% YoY decrease. There are increasing oversupplies in the Chinese market, which is also experiencing economic recessions. The second largest market, India, is becoming increasingly self-reliant underpinned by equipment expansion and import regulations.
  - **Demands** are expected to mark a 3.9% YoY increase, 4,696 KT.

**<Status of Synthetic Fiber Raw Materials Demands and Supply>** (Unit: 1,000 tons)

		2015		2016				2017	
		Total		1H		2H		Total	
			G.R		G.R		G.R		G.R
Syn. Fiber Raw Mat's	Pro	6,941	-6.7%	3,301	-7.7%	3,344	-0.2%	6,645	-4.1%
	Exp	3,170	-9.7%	1,342	-20.1%	1,231	-17.2%	2,573	-18.8%
	Imp	521	-11.4%	216	-19.8%	232	-4.5%	448	-12.6%
	Dem	4,291	-5.0%	2,176	0.3%	2,344	11.4%	4,520	5.8%

Data: KPIA  
Note: Production is based on sales

### (3) Synthetic Rubber

#### [Status of 2016]

- In 2016, Korea's synthetic rubber industry experienced decreases all in productions, demands, and exports.
- Productions decreased to 893 KT, a 8.8% YoY decrease, affected by worsened profitability due to sluggishness in tire production and rises in raw material prices.
- Exports decreased to 588 KT, a 6.6% YoY decrease, due to reduced export capabilities affected by production and oversupplies in the Chinese market.
- Demands decreased to 385 KT, a 12.2% YoY decrease, due to reductions in the tire industry that is the most important forward industry.

#### [Prospect of 2017]

- In 2017, the synthetic rubber industry is expected to enjoy a surge of productions, exports, and demands.
- **Productions** are expected to reach 924 KT, a 3.6% YoY increase, rebounding from the poor market conditions in the previous year and the expansion project.
- **Exports** are expected to be 610 KT, marking a 3.8% YoY increase by production surge and improved demands.
- **Demands** are expected to increase by 2.2% compared to the

previous year, reaching 393 KT favored by increased domestic demands following the expected increases in tire production (2.1% YoY increase) in 2017.

		2015		2016				2017	
		Total	G.R	1H		2H		Total	G.R
				Total	G.R	Total	G.R		
Syn. Rubber	Pro	967	-4.2%	451	-11.1%	442	-6.3%	893	-8.8%
	Exp	629	-4.2%	299	-7.2%	289	-6.0%	588	-6.6%
	Imp	90	9.2%	39	-12.2%	41	-9.0%	80	-10.6%
	Dem	428	-1.6%	191	-16.7%	194	-7.4%	385	-12.2%
								924	3.6%
								610	3.8%
								79	-1.5%
								393	2.2%

Data: KPIA,  
Note: Production is based on sales

### (4) Export

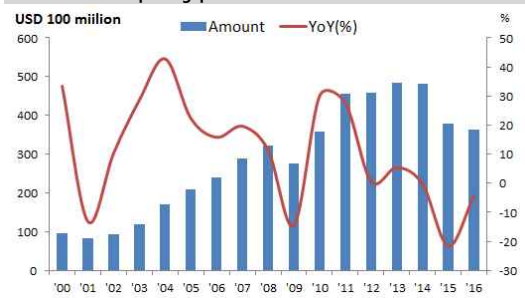
#### [Status of 2016]

- In 2016, the petrochemical industry's total exports were 36.2 billion dollars, marking a 4.3% YoY decrease directly affected by declines in export prices following oil price cuts.
- The volume increased by 2.6% following the major equipment expansion in 2015~2016, but the export price decreased by 6.7% due to the drop of oil prices.
  - \* Export volume (KT, YoY change %): (2015) 33,764 (5.1) → (2016) 34,628 (2.6)
  - \* Export price (\$/ton, YoY change %): (2015) 1,119 (-25.4) → (2016) 1,044 (-6.7)
  - \* oil price (\$/bbl, Dubai): (2015) 51 (-47.1) → (2016) 41 (-18.8)

#### [Prospect of 2017]

- Exports will be increased to 43.0 billion dollars, a 18.9% YoY increase, due to prices going up following rises in oil and raw material (naphtha) prices.
- **The export volume** is expected to be 36,139 thousand tons, a 4.4% YoY increase, owing to increases in export capabilities led by equipment expansion and the demand growth in the North-East Asia.

<Trend of Exporting petrochemical Products for Each Year>



Data: KITA

## II. Olefins & Aromatics

### 1. Olefins (Ethylene, Propylene, Butadiene)

#### ITEM : Ethylene

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	8,275	8,524	8,735
	Import	201	147	135
	Total	8,476	8,671	8,870
Demand	Domestic	7,842	7,918	8,000
	Export	634	753	870
	Total	8,476	8,671	8,870
Year-end Capacity		8,640	8,670	9,000

#### 1) The 2016 Results

Ethylene balance was kept tight in Asia and ethylene price was continuously rising due to the strong demand in downstream such as SM and VCM. Also, Crackers had reduced production due to T/As, Asahi Kasei NCC plant scrap, unplanned S/D and Shell's long term trouble.

Due to the strong demand in Asia, production in Korea was increased by 250KTA year on year.

#### 2) The 2017 Forecast

While the ethylene balance in Asia was tight due to the reduction of MTO operation rate and start-up of stand-alone derivatives from the first half. However, the balance will be changed to even or long position from second half of the year due to the North America ECC start up and it could affect both side of monomer and polymer. Also, Korean cracker (KPIC) will be revamped in June, and increasing monomer production.

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#### ITEM : Propylene

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	6,981	7,462	7,650
	Import	449	265	245
	Total	7,430	7,728	7,895
Demand	Domestic	6,172	6,037	6,248
	Export	1,258	1,690	1,647
	Total	7,430	7,728	7,895
Year-end Capacity		7,604	8,204	8,420

#### 1) The 2016 Results

After SK Advanced (PDH 600KTA) start up in early 2016, the balance in Korea was expected to be over-supplied. However, the over-supply compensated most of production trouble at Chinese units and reduction of OCU operation rate. Also, market demand was increased due to good economics of downstream, such as PP, AN. The import volume had decreased compared to previous year.

#### 2) The 2017 Forecast

During the first half of 2017, propylene balance was tight due to limited expansion, supply decreased with T/A in NEA and prolonged derivatives economic benefits. However, the production will be increased due to the new Chinese C/MTO and KPIC's expansion and less T/A from second half of the year. And also the economics of demand will be getting worse. So, production increase will be larger than demand growth.

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#### ITEM : Butadiene

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	1,188	1,235	1,275
	Import	426	410	398
	Total	1,614	1,645	1,673
Demand	Domestic	1,458	1,490	1,512
	Export	155	156	161
	Total	1,614	1,645	1,673
Year-end Capacity		1,322	1,322	1,322

#### 1) The 2016 Results

There were some troubles of BD plants in Southeast Asia and more T/A in Northeast Asia than usual.

Particularly China, demand was very strong due to increasing domestic car sales and production in 4Q 2016. So BD balance in Northeast Asia was very tight and price surged.

#### 2) The 2017 Forecast

BD demand is expected to increase slightly in accordance with tire industry growth(Rubber demand increase : 2 ~ 3%). There are T/A plans in 2Q, Korea, which are SK Global(NCC 190KTA), KPIC(NCC 470KTA) and YNCC(BD 220KTA). So BD balance in Asia will be tight in 2Q of this year.

But Opal's new BD plant has been started in Feb and Sailboat, Ningmei also will start in first half, Thus supply tightness could be eased year on year.

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## 2. Aromatics (Benzene, Toluene, Xylene)

### ITEM : Benzene

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	6,058	5,827	6,200
	Import	47	93	80
	Total	6,105	5,921	6,280
Demand	Domestic	3,523	3,817	3,950
	Export	2,582	2,103	2,330
	Total	6,105	5,921	6,280
Year-end Capacity		6,443	6,919	7,059

#### 1) The 2016 Results

Despite the new capacity of Hyundai Chemical in October, Benzene production has been decreased to 5,827 KTA in 2016 compared to 6,058 KTA in 2015, due to the T/As of GS Caltex, Lotte Chemical, Hanwha TOTAL, SKGC, UAC, YNCC and OCI.

In 2016, the domestic demand has been increased by 294 KT mainly due to the expansion of the phenol plant of Kumho P&B as well as decreased SM plants T/As from 2015.

#### 2) The 2017 Forecast

The production volume in 2017 is expected to be increased to 6,200 KT from 5,827 KT in 2016. Although some of the reformers as well as crackers have planned T/A in 2017, the Benzene loss by the T/A will be less than the previous year. And there are some additional volume from Hyundai Chemical which started its commercial production from last October, S-Oil, KPIC and Hanwha-TOTAL which have T/A for revamping in 1<sup>st</sup> half of the year.

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Although most of the local SM plants have planned T/As including LG Chemical, Hanwha-TOTAL, Lotte Chemical and YNCC, the demand is expected to be increased by 133 KT. The main reason for the increase is the phenol plant of Kumho P&B which is operating from year 2016.

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### ITEM : Toluene

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	1,583	1,722	1,760
	Import	760	561	550
	Total	2,343	2,283	2,310
Demand	Domestic	1,921	1,751	1,800
	Export	422	533	510
	Total	2,343	2,283	2,310
Year-end Capacity		2,251	2,261	2,276

#### 1) The 2016 Results

After the major PX expansion in 2014, a majority of Toluene productions were supplied to TDP and STDP, But Heavy T/A and Troubles in Domestic PX producer decreased domestic Toluene demand. Accordingly, exports increased to 25% compared to the previous year, whereas imports decreased by 26% due to heavy T/A and Troubles in domestic PX Producer. In the beginning of 2016, they say strong gasoline blending demand may overwhelm Toluene market, However technically Blending demand was not that strong beyond expectation.

#### 2) The 2017 Forecast

Unexpectedly, robust BZ market leads Toluene demand from petrochemical sector by high TDP operation rate. Furthermore, Hanwha Total and Hyundai chemical intends to rise up TDP operation by consuming domestic Toluene within local Refining/Petrochemical complex such as Daesan.

Nevertheless Strong demands for gasoline and PX in China will lead to stimulate exports to the Chinese market, so it seems to stay tight balance inside domestic market.

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### ITEM : Mixed Xylene

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	2,688	3,063	3,150
	Import	1,830	1,838	1,850
	Total	4,519	4,902	5,000
Demand	Domestic	3,295	3,878	3,950
	Export	1,224	1,024	1,050
	Total	4,519	4,902	5,000
Year-end Capacity		3,313	4,320	4,325

#### 1) The 2016 Results

Northeast Asian mixed xylenes supply had been ample with high operation and Hyundai chemical in S.Korea Started up Nov, 2016 and MX balance certainly changed to long. It, MX Spread with Naphtha was larger at around \$270 per mt in August 2016 and the 2016 annual average was around \$250 per mt. The mixed xylenes margin has down significantly since then.

Furthermore, China started up a large mixed xylenes capacity in East China and it means that China has enough reformer-based mixed xylenes for high PX operation and In addition, China's dependency on imported isomer mixed xylenes became very small.

#### 2) The 2017 Forecast

We can describe the current 2017 MX market only this word "Surplus", as the Benzene/MX and toluene price spread has increased due to the relatively strong benzene price, the MX margin from TDP based on the market Toluene price has continued to improve substantially. Since last december, the TDP MX margin has been positive.

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Actually, The MX market had been tight since mid-2015, but it has recently become longer, the US MX price has decreased in line with toluene. Consequently, the price spread between the United States and Asia has decreased and the arbitrage window for Asian MX to the United States has been closed.

Whereas, there will be something what the current situation could be changed from May by several Japanese MX Suppliers will undertake turnarounds. Their total production loss might be around 120KTA in May and June. In the second quarter, the Northeast Asian MX market will be firmer, however after that the balance might be come back to long. The key factor is clearly PX economics.

## ITEM : Para Xylene

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	8,915	9,484	9,550
	Import	84	44	50
	Total	8,998	9,527	9,600
Demand	Domestic	3,136	3,093	3,100
	Export	5,862	6,435	6,450
	Total	8,998	9,527	9,550
Year-end Capacity		10,080	10,336	10,507

### 1) The 2016 Results

In 1Q 2016, PX price rose to \$800/MT from \$700/MT due to expectations for the Mogas market and some PX plants' T/A. In addition, new PTA plant's start-up (Hanbang, 2,200KTA) in china at the end of 1Q led to supply/demand tightness.

However, when PX price reached \$800/MT and PX/Naphtha spread reached \$400/MT, PX producers, PTA producers and some Traders had started PX/Naphtha spread hedging play. As a result, PX price had moved from \$780/MT to \$820/MT range from 2Q to early 4Q. In 4Q, PX supply and demand remained long due to T/A by major PTA companies, but PX price had risen due to OPEC's production reduction agreement.

### 2) The 2017 Forecast

In 1Q 2017, PX price started to rise with oil price hikes and solid polyester demand. However, in mid-March, the PX price declined due to the sharp price drop in the Chinese futures market following

uncertainties in oil prices and the shrinking liquidity in China, and also high PTA inventory and Reliance's PX selling to Asia made PX price to drop.

Nevertheless we expect PX price and spread in 2Q to recover on the back of PTA supply/demand rebalancing due to T/A of PTA producers in April and increased demand expectation of mogas and polyester market.

In 2H 2017, PX price will expected to be weak because of oversupply which is new start-up of Nghi Son PX(700KTA) in Vietnam and impact of Reliance's (2,200KTA) PX selling from India.

## III . Polyolefins



## Polyolefins

### ITEM : LDPE (including L-LDPE, EVA)

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	2,667	2,703	2,754
	Import	117	121	119
	Total	2,784	2,824	2,873
Demand	Domestic	1,223	1,289	1,347
	Export	1,561	1,535	1,526
	Total	2,784	2,824	2,873
Year-end Capacity		2,700	2,720	2,760

#### 1) The 2016 Results

In 2016, the total domestic LDPE production (including LLDPE/EVA) had increased by 1.3% (2,703KT) compared to 2015, as Hanwha Total expanded the production capacity in 4Q 2016 and the capacity will be increase by 40,000mt/year. The total amount of imported LDPE products were similar to that of in year 2015. Domestic demand of LDPE had increased by 5.4% with global economy recovery and china demand, as the Chinese government continues to promote self-reliance on petrochemical products.

#### 2) The 2017 Forecast

LDPE in Northeast Asia will continue to expand at an average rate of 4.0% per year until 2021. Its growth rate is supported by China's high ethylene vinyl acetate (EVA) demand growth. During the past few years, EVA demand in China grew at more than 10% each year.

Northeast Asia LLDPE demand are forecast to expand at an average annualized growth rate around 5.5% per year over the next five years. especially high-valued mLLDPE for packaging, is expected to grow at a

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faster rate with competitive pricing. Although China has a small plant for mLLDPE, this rapidly growing demand will be entirely met by imports during the forecast years.

In Korea, the total domestic LDPE production will be 2,754KT, increase by 1.8%. Hanwha Total revamped up 40KT(EVA) in 4Q 2016 could influenced on domestic demand.

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### ITEM : HDPE

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	2,184	2,129	2,193
	Import	49	55	55
	Total	2,233	2,184	2,248
Demand	Domestic	1,028	1,071	1,125
	Export	1,205	1,112	1,123
	Total	2,233	2,183	2,248
Year-end Capacity		2,385	2,385	2,385

#### 1) The 2016 Results

In 2016, Korea's HDPE production was decreased by 2.5% at 2,129 thousand ton compared to 2015 according to the Turn-around such as Lotte Chemical, SK Global Chemical, Daelim etc.

The domestic demand was increased by 4.2% due to the recovered domestic economy. The export volume was decreased by 7.7% because of less production and slow down of global trade.

#### 2) The 2017 Forecast

In 2017, There will be a few scheduled T/A compared to last year. Production is expected to be 2,193 thousand ton which is increased by 3.0% compared to previous year.

The domestic demand is expected to be moderated due to the stable oil price and market environment. But the export volume will be similar to previous year. Chinese high self-sufficiency rate will limit the import volume growth from Korea.

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### ITEM : PP

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	4,051	4,088	4,277
	Import	31	29	29
	Total	4,082	4,116	4,306
Demand	Domestic	1,570	1,569	1,600
	Export	2,512	2,548	2,706
	Total	4,082	4,116	4,306
Year-end Capacity		4,257	4,257	4,457

#### 1) The 2016 Results

In 2016, the domestic production of PP was 4,088KT, increased by 0.9% compared to 2015. The import of PP was 29KT, which is similar with 2015. Domestic demand of PP was 1,569KT, increase by 4.7% due to lower feedstock price with recovery of construction and car industry. PP export volume was slightly increased by 1.4% in 2016.

#### 2) The 2017 Forecast

Northeast Asia is the world's largest PP producing region, holding about 40% of global nameplate capacity in 2016. The capacity will continue to expand in the next five years, and it is expected to capture almost 43% of the global capacity by the end of 2021.

Northeast Asia captured 42% of the global PP consumption in 2016 and remained the number-one demand region in the world. The proportional demand share is expected to further expand in the next five years to more than 44% by 2021.

In Korea, Hyosung started up their 200KTA plant on Jan 2017 in Ulsan and S-oil has the plan to new plant operation for 400KTA in end of 2017. Those expansion would have effect on domestic market.

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## Styrenics

ITEM : PS

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	591	628	670
	Import	31	27	25
	Total	622	654	695
Demand	Domestic	314	349	359
	Export	309	300	267
	Total	623	649	626
Year-end Capacity		726	741	686

## IV. Styrenics

### 1) The 2016 Results

The production was 670 thousand tons, 6.1% higher than that in 2015 due to sales increase in domestic market.

The demand was 649 thousand tons, 4.1% higher than that in 2015 mainly came from 11.1% YoY increase in domestic sales.

### 2) The 2017 Forecast

The production will be 7.5% lower than that in 2016 due to LGC HIPS business withdrawal. The demand will be 2.9% higher than that in 2016 mainly came from 11.6% YoY increase in domestic construction demand.

ITEM : ABS

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	1,684	1,841	1,822
	Import	6	10	10
	Total	1690	1,851	1,832
Demand	Domestic	445	499	527
	Export	1,246	1,352	1,305
	Total	1,690	1,851	1,832
Year-end Capacity		1,786	1,936	2,031

### 1) The 2016 Results

2016 ABS Domestic production was increased 9.3% YoY to 1,841kT by automotive demand and 150kT expansion of LG chem.

Demand for both domestic and exports grew by 9.5% YoY to 1,851kT. Exports to US, Mexico, Thailand and Vietnam increased nearly 20% led the exports growth.

### 2) The 2017 Forecast

Domestic capacity is expected to increase additional 95kT in 2017. LG chem and Lotte advanced materials are planning to expansion. However, production will decrease by 19kT due to other maker's T/A plan.

ITEM : SM

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	2,903	3,041	2,970
	Import	779	806	844
	Total	3,682	3,847	3,814
Demand	Domestic	2,435	2,554	2,592
	Export	1,247	1,293	1,222
	Total	3,682	3,847	3,814
Year-end Capacity		3,266	3,266	3,266

### 1) The 2016 Results

Due to relatively less SM T/A than last year, Korean SM production was 3,041kT (+4.8%), and export volume was 1,293kT (+3.7%).

\* LG Daesan (170kT) : 5/9 ~ 5/26 T/A (Loss : -8kT)

\* HTC #2 (650kT) : 9/28 ~ 10/17 T/A (Loss : -36kT)

\* SKGC (405kT) : 11/8 ~ 12/5 T/A (Loss : -31kT)

\* Total T/A Loss : -75kT

Korean domestic demand was 2,554kT (+4.9%).

\* LG Chem expanded 100kT on their ABS plant from Oct., 2015.

SM-Naphtha spread increased to \$750~800 in March & April due to lots of SM T/A, but it decreased to \$550 level due to new SM S/U (Xinri #2, Ningbo Daxie) in June and the expectation for weak demand of Q4 in September. However, it rebounded again over \$700 in November and December as per Unexpected SM plants'trouble (Westlake, Styrolution) in USA.

### 2) The 2017 Forecast

Most of SM producers in Korea except SKGC have T/A plan in

2017. So, estimated production would be decreased to 2,970KT (-2.3%).

- \* LG Yesou (500KT) : 3/8 ~ 4/12 T/A (Loss : -49KT)
- \* HTC #1 (400KT) : 4/16 ~ 5/1 T/A (Loss : -18KT)
- \* LOTTE (580KT) : 5/15 ~ 6/14 T/A (Loss : -49KT)
- \* YNCC (290KT) : 5/29 ~ 6/23 T/A (Loss : -21KT)
- \* LG Daesan(170KT):10/23 ~ 11/10T/A (Loss: -9KT)
- ※ Total T/A Loss : -146KT

Korean domestic demand would be 2,592KT (+1.5%) amid no expansion plan. SM-Naphtha spread would be strong during 1<sup>st</sup> half of 2017 due to lots of SM T/A, but it would decrease during the 2<sup>nd</sup> half of 2017 as per new SM plants'S/U in China. (Qingdao Jianye, Ningbo Keyuan)

## V . PVC

### PVC

#### ITEM : PVC

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	1,508	1,538	1,520
	Import	119	121	115
	Total	1,627	1,659	1,635
Demand	Domestic	1,038	1,124	1,115
	Export	589	535	520
	Total	1,627	1,659	1,635
Year-end Capacity		1,540	1,540	1,540

#### 1) The 2016 Results

Lowered-oil price made ethylene based PVC price competitive compared to previous year. Korean Domestic PVC demand increased by 8.2% in 2016 mainly driven by increasing demand in construction sector such as Window profile & Pipes.

#### 2) The 2017 Forecast

Lower-oil prices will continue in 2017 and Korean domestic demand will remain stable but slowing down growth of China will affect PVC regional demand negatively. It is expected that China's PVC export volume will increase continuously and may become one of the largest PVC exporter in the region.

### ITEM : VCM

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	1,583	1,605	1,597
	Import	6	14	8
	Total	1,589	1,619	1,605
Demand	Domestic	1,511	1,540	1,530
	Export	78	79	75
	Total	1,589	1,619	1,605
Year-end Capacity		1,630	1,630	1,630

#### 1) The 2016 Results

Overall, domestic demand slightly increased in 2016 as the demand for self - consumption increased. In Korea, domestic demand mostly accounted for self-consumption to produce PVC.

Asahimas, an Indonesian producer, expended its VCM capacity by double to 800,000 metric tons per year in 2016. Asian VCM market balance will be shifting to 'loose' position. As a result, a price spread between PVC and VCM was widened compared to previous year.

#### 2) The 2017 Forecast

There will be no significant change of VCM supply-demand balance in Korea, 2016, except that total export volume is expected to show a slight increase with more VCM production compared to last year's.

Considering VCM expansion in Indonesia scheduled to start up in March 2016, Asian VCM market balance will be shifting to 'loose' position. As a result, a price spread between PVC and VCM is likely to be widened, which will lead to an increase of VCM trading volume.

## Synthetic Rubber

ITEM : SBR/BR

(Unit: KTA)

### VI. Synthetic Rubber

SBR		2015	2016	2017(P)
Supply	Production	497	455	504
	Import	67	57	57
	Total	564	512	561
Demand	Domestic	271	235	240
	Export	293	277	321
	Total	564	512	561
Year-end Capacity		626	520	620
BR		2015	2016	2017(P)
Supply	Production	482	438	420
	Import	23	23	22
	Total	505	461	442
Demand	Domestic	167	150	154
	Export	337	311	288
	Total	504	461	442
Year-end Capacity		591	591	591

#### 1) The 2016 Results

Due to economic depression of developed countries and sluggish recovery of China, the world motor production grew only 2.4% and tire production grew 3.1% compared to 2015. Sump of downstream industries, the global demand of synthetic rubber has increased only approximately 1%.

In Korea, the production of SBR and BR was decreased by 8.8% compared to 2015 due to lack of domestic demand and high raw material price in Asia. Also, export quantity was declined by 6.7% compare to 2015 because of intense competition in global market.

#### 2) The 2017 Forecast

In 2017, the global demand of synthetic rubber is expected to be 8,326KT which is increased by 1.8% compared to 2016. The demand of synthetic rubber in Korea is expected to be 394KT which is increased by 2.3%. Because most of completed new expansion plans in 2017 are focused on Solution SBR, the competition will be intensified in S-SBR market as well as E-SBR and BR market. The export to USA would be decreased due to anti-dumping issue of E-SBR. However, the impact to Korean synthetic rubber makers would be limited because the export portion to USA has been insignificant compare to other markets.

### VII. Synthetic Fiber Raw Materials

## Synthetic Fiber Raw Materials

### ITEM : AN

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	670	710	740
	Import	105	135	170
	Total	775	845	910
Demand	Domestic	550	600	660
	Export	243	241	260
	Total	793	841	920
Year-end Capacity		850	850	850

#### 1) The 2016 Results

Compared to 2015, domestic AN demand in Korea was increased 9% mainly due to improved ABS demand but Export was stable as new plants in China had operated well.

In terms of Supply, production and Import was increased 6% and 29% respectively for recovery of the demand.

#### 2) The 2017 Forecast

Domestic demand is expected to grow 10% in accordance with positive outlook in ABS and strong growth in other derivatives' sectors. Export also will be expanded by 8% for the same reason.

Meanwhile, supply will rise by 8% because of the increased quantities in import and T/A period shortening.

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### ITEM : Caprolactam

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	92	176	215
	Import	84	36	10
	Total	175	212	225
Demand	Domestic	171	175	170
	Export	4	37	55
	Total	175	212	225
Year-end Capacity		270	270	270

#### 1) The 2016 Results

The industry's leading suppliers carried out production reductions in response to the enduring oversupplied market conditions, while Capro Corp. increased production in an effort to expand overseas market.

#### 2) The 2017 Forecast

The over-supplied market is expected to be more-balanced, following production reductions by major suppliers.

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### ITEM : MEG

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	1,279	1,222	1,265
	Import	323	276	276
	Total	1,602	1,498	1,541
Demand	Domestic	1,015	1,017	1,053
	Export	587	481	489
	Total	1,602	1,498	1,541
Year-end Capacity		1,665	1,665	1,665

#### 1) The 2016 Results

Due to the high price of raw material, EG market was sluggish in 2016. Operation rate has declined for 3.4% from 76.8% in last year. Production was decreased by 4.5% at 1,222 thousand ton compared to 2015.

The export volume was decreased by 18.1% because of less production and more sales to domestic market.

#### 2) The 2017 Forecast

There is no change of production capacity in 2017, but the operation rate is expected to incline due to the relatively favorable ethylene-EG spread compared to previous year. It is expected to deepen its tightness compared to the previous year for the supply situation in Korea with the influence of T/A such as Lotte Chem, KPIC, LG Chem etc.

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### ITEM : TPA

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	4,822	4,453	4,470
	Import	-	1	1
	Total	4,822	4,454	4,471
Demand	Domestic	2,508	2,678	2,730
	Export	2,314	1,776	1,741
	Total	4,822	4,454	4,471
Year-end Capacity		6,340	6,340	6,340

#### 1) The 2016 Results

In 2016, the worsening of TPA margin has reduced the production by 369kt to 4,453kt in line with year 2015.

The Korean domestic demand remained relatively stable. On the other hand, the export market competition was severe and profitability was not good.

#### 2) The 2017 Forecast

TPA operation in Europe, India, etc. is not good in the first half owing to some technical issues. Korean exports will take advantage from this return. Thus we anticipate high operation in the first half of this year.

However, there are concerns about a possible decline in some orders due to issues such as Turkish anti-dumping in the second half.

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### VIII. Chemicals

ITEM : Phthalic Anhydride

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	385	377	370
	Import	1	1	1
	Total	386	377	370
Demand	Domestic	201	211	198
	Export	184	166	171
	Total	385	377	369
Year-end Capacity		405	405	405

1) The 2016 Results

DOMESTIC MARKET, Due to the growth of Non-phthalate use, the demand for plasticizers, paints and pigments was decreased compared to the previous year.

EXPORT MARKET, The rise of the raw material price and the rise of the demand for the Indian market have led to a significant increase of the international price for PA. Since the second half of the year, the international price for PA has remained strong a tight supply in the Chinese market caused by Chinese environmental regulation.

2) The 2017 Forecast

DOMESTIC MARKET, Demand is expected to be the same level as last year. If the international price rise due to a tight supply of raw materials, the domestic price be positioned to a strong level.

EXPORT MARKET, PA spread is expected to remain high level due to the strong demand in emerging market such as India.

ITEM : Acetic Acid

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	520	559	531
	Import	6	-	12
	Total	526	559	543
Demand	Domestic	372	376	393
	Export	163	177	153
	Total	535	553	546
Year-end Capacity		570	570	570

1) The 2016 Results

o Supply & Demand : Continuing oversupply and weak demand in general

- Supply

- Overall Chinese AA plants kept healthy operation rate
- Chinese idled plant Henan Longyu 400kty restarted(Sep.2016)

- Demand

- Weak demand in PTA and EA following global economy recession
- Domestic PTA operating ratio lowered to 74% (Δ2%, 76% in 2015)

o Price : Stable to weak but rebounded in Q4

- Overall price decreased in line with weak supply & demand

(2015 : \$427 → 2016 : \$333/ton)

- But price rebounded from Q4 due to strong coal price for feedstock

2016	Q1	Q2	Q3	Q4	Average
AA Price	\$311	\$321	\$313	\$385	\$333

※ Chinese coal price (Fob qinghuang dao) Jul '16 \$65 -> Nov '16 \$100/ton

2) The 2017 Forecast

o Supply & Demand : Oversupply might be somewhat digested because of no new AA capacity expansion and demand increase

- Supply

- No noticeable new AA plants expansion by 2020
- Supply reduction following concentrated AA plant's shut down

- Demand

- Demand will be recovered reflecting natural increase of demand on PTA and EA
- New demand is forecasted from Chinese new ethanol plant operation

o Price : Stable to firm

- Bullish price trend is expected because of oversupply mitigation and strong chinese coal price.

- Stable to firm price trend will be supported by heavy turnaround plan in several AA plants during Q2 and Q3

※ AA Price(cfr NEA) : 2016 Q4 \$385 -> 2017 Q1 \$427/ton

**ITEM : Phenol**

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	943	1,032	1,120
	Import	120	108	40
	Total	1,063	1,140	1,160
Demand	Domestic	832	882	860
	Export	275	273	300
	Total	1,107	1,155	1,160
Year-end Capacity		980	1,180	1,280

**1) The 2016 Results**

**Demand**

- Good and high O/R for Anone Base CPL
- Increasing Phenol demand, due to expansion for BPA
- Nearly 90% O/R of CPDC in Taiwan. BPA Expansion (Covestro)

**Supply**

- Despite of new expansion, tight supply from some troubles and G20 summit meeting in 2nd half
- Expansion: KP(B300KT), PTT(250KT)
- Trouble : Shell, PTT, CCP and so on

**2) The 2017 Forecast**

**Demand**

- Healthy demand from new Anone Base Carpro Plant
- Shenyuan(200KT) '17.1Q, CPDC Rudong (150KA) '17.4Q

**Supply**

- Tight Balance in 1H by focus on T/A of main suppliers

- Inflow low value deep-see cargo from end of '16 makes market down

- Overweight on new comers such as CNOOC and Petro Rabigh in 2H
- Control possibility of oversupply, due to adjustment of O/F considering intra-regional Maker profitability

**ITEM : 2-Ethyle Hexanol**

(Unit: KTA)

		2015	2016	2017(P)
Supply	Production	410	410	400
	Import	113	156	140
	Total	523	566	540
Demand	Domestic	402	460	480
	Export	92	104	56
	Total	494	564	536
Year-end Capacity		410	410	400

**1) The 2016 Results**

In 2016, C3 price had been on a strong uptrend all through the year differently from market forecast because the majority of Asian crackers' quadrennial planned maintenance was implemented and there were little projected C3 expansion on stream. It caused C3 supply in the market limited and the price remained strong and firm. On the other hand, 2EH demand and price had been weak due to the bearish market sentiment from downstream and the 2EH oversupply condition. Therefore, 2EH-C3 spread had kept narrowed, even reversed, making 2EH producers' profitability worsen.

**2) The 2017 Forecast**

Newly expanded C3 plants (PDH/MTO) of 2 million MT are expected to come on stream in China this year, helping C3 supply condition improve and lowering C3 price. Meanwhile, there are few near-term planned expansion projects of 2EH in this region. Thus, in 2017, 2EH-C3 spread is expected to get better than last year, helping 2EH profitability recover.