

# REPUBLIC OF CHINA

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## The Petrochemical Industry of Taiwan

### Continuing to play major national economic role

Taiwan used to be the “world processor” some 40 years ago when huge tonnage of processed petrochemical goods was shipped all over the world. Since then the petrochemical industry has become indispensable in the Taiwanese economy. Up to now, the total petrochemical production value still accounts for 30% of the whole manufacturing sector. The Taiwanese petrochemical industry, through long term development, has become a fully integrated system, consisting of up, middle, and downstream sectors.

However, the industry did suffer a lot in recent decade. People’s excessive anti-pollution protest, together with strict environmental regulations, has badly restrained the construction of new petrochemical facilities. So the petrochemical production capacity of Taiwan has gradually lagged behind that of other countries which started much later.

Petrochemicals are widely used in national developments and people’s daily life. Petrochemical industry is a highly global industry that the business situation is intimately geared up with the economic prosperity and the market moves. The Taiwanese GDP growth in 2012 was forecast to be 4%; however the outcome was dissatisfied as to fall down to only 1.25%. Compared with the stagnant 2011, the year of 2012 was one that started to climb from deep valley. But the recovery has been weak. It was not until the 4<sup>th</sup> quarter that the production and trade revealed signs of improvement, as indicated by the rise of cracker operation rate. Feedstock price hikes, like benzene and butadiene, significantly eroded the profitability of producers.

The year of 2012 was a year of drastic change in the part of commercial, political, economical and many others. The world has been suffering from economic recession and currency inflation or deflation. Particularly in the US, financial cliff has been a nightmare that threatens the national economy. The European debt crisis has also heavily reduced people’s buying power which in turn depressed the consumption of industrial products. As a vast majority of Taiwan’s petrochemical products is sold to China market, the economic growth shrinking of China has greatly impacted the export record of Taiwan.

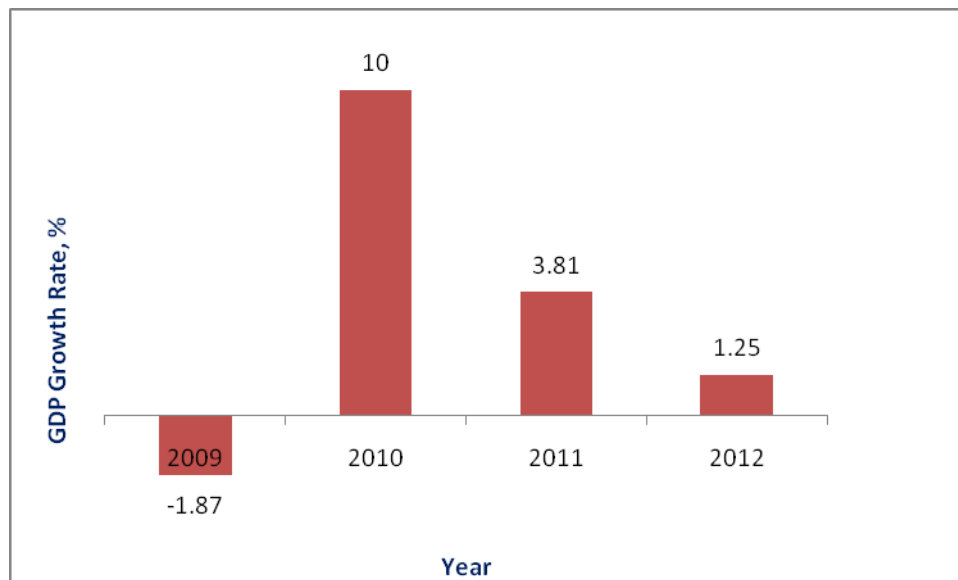
The GDP growth of Taiwan in 2012 was only 1.25%, again ranking the lowest in Asia 4 little dragons. The petrochemical business was slowing down. The government found no way to improve economic development, although it has taken different measures.

The petrochemical industry created a total production value of 1.82 trillion NTS or 60 billion USD last year. This is a reduction of 5.5% as compared with the figure of previous year. However, it still accounted for about 30% of the manufacturing sector as a whole.

Fig 1 shows the GDP growth in Taiwan in recent years. Generally speaking, petrochemical production contributed nearly one third of the national economic performance.

In 2012, the total production value of the petrochemical related industry , which includes textile, wearing apparels, chemical materials, chemical products, petroleum & coal products, rubber products, and plastic products etc., accounted for 29.8% of the total manufacturing sector in Taiwan (Fig 2). The aggregate production value, as the government statistics indicated, was as high as NT\$ 4.00 trillion dollars, while the total manufacturing sector created NT\$14.50trillion dollars.

**Fig 1 Taiwan's Economy Growth Rates in recent years**



Taiwan's GDP peaked in 2010 when the economy had a robust recovery from prior deep valley in 2009. The Taiwanese petrochemical firms enjoyed fairly satisfied profitability. In 2012, the business cycle slowed down again along with the GDP decline due to the worldwide recession. Last year was a difficult year; the industrial performance was poor enough.

Fig 2 Petrochemical--A trillion NT \$ dollar Industries in Taiwan



## The Ethylene Capacity, Production, and Trade

The ethylene production is always an important indicator for the petrochemical industry. Last year, the total production of ethylene in Taiwan amounted to 3,478,448MT, a minor decrease of 1.24% compared to the previous year. The two ethylene makers both conducted turnarounds that lowered the operation rates. They also adjusted the capacity utilization, responding to the change of market demand. Ethylene import was 373,205 MT, down 6.64 over 2011. While ethylene export recorded 123,129 MT; this reflected weak domestic demand. Some ethylene was shipped to overseas location by producer for captive use of derivative manufacture. The total apparent consumption of ethylene in Taiwan was 3,703,374 MT last year, the decrease against 2011 was minor, but was beyond expectation.

Fig 3 shows the petrochemical industry of Taiwan ranks 10<sup>th</sup> largest in the world in terms of annual ethylene capacity. However, with the rise of other new economies, this rank is being lagged behind.

Fig 3 Ethylene Capacity Ranks 10<sup>th</sup> Largest in the World

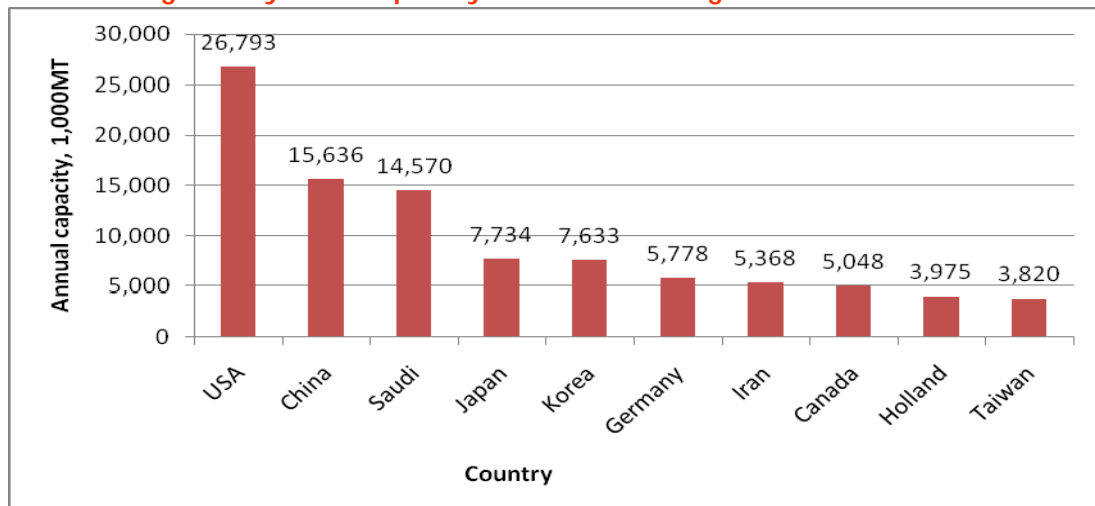
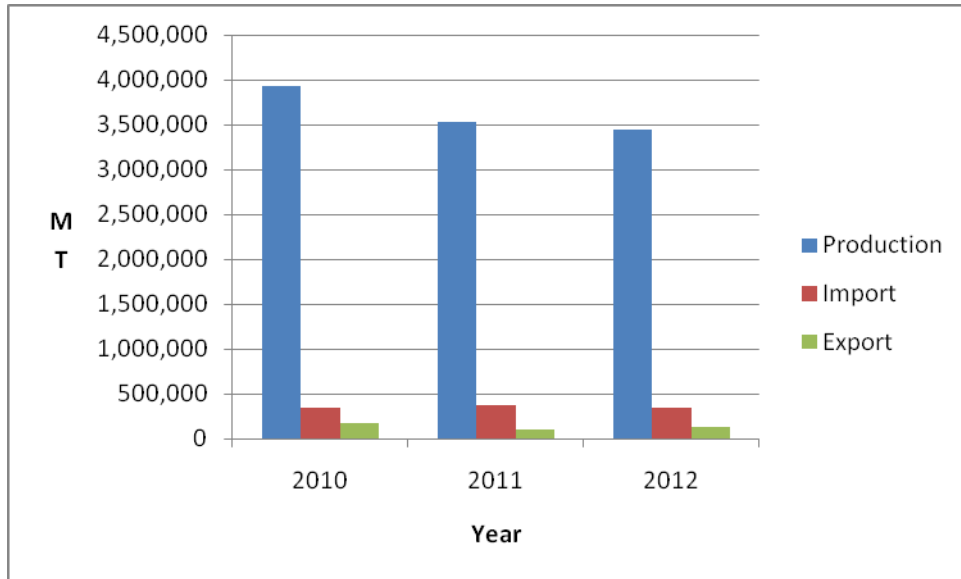


Fig 4 shows the ethylene production and trade statistics in Taiwan in recent year.

Currently, there are 6 ethylene plants under running, with a total capacity of 3.820, 000MT per year. CPC Corporation, Taiwan (CPC) and Formosa Petrochemical Corporation (FPCC) are producing olefins and aromatics based mainly on the captive feed stocks from their refineries. Also, Both FPCC and CPC have been expanding their refinery capacities and pushing up the development of C4, C5, C9 petrochemicals.

Fig 4 Production and Trade of Ethylene in Recent Years



CPC owns 3 naphtha crackers (NC 3, NC 4, NC 5), which have been operating for years. The old NC1 and NC2 have been scrapped. FPCC's NO.1, NO.2 naphtha crackers were started up in 1998 and 2000 respectively, and a 3<sup>rd</sup> naphtha cracker with an ethylene capacity of 1.20MMMT was also on stream in May 2007. In addition, FPCC's No 1 cracker completed debottlenecking to raise capacity in year-end 2002.

CPC completed revamping of its NC 3 to raise annual capacity of ethylene to 720,000MT in June, 2012. This is a build-and-scrap project. The scheduled time of commissioning would be June, 2013. The old NC3 which has been running for more than 30 years has been shut down in June 2012 for permanent closure.

## Recent Status of Petrochemical Complexes

There are 4 major petrochemical centers in Taiwan. All of them have been well established.

### 1. The Tou-Fen Petrochemical Complex

This complex is located in the north of Taiwan where natural gas was discovered in

early years. Petrochemicals production based on the natural gas produced there around has been limited following the source of local natural gas became exhausted. The ethane cracker was shut down in mid-1990 due to lack of ethane supply, and was scrapped in mid-1996.

Some of the petrochemical plants located in this complex have shutdown or out-moved subsequently. These are VCM plant of Taiwan VCM Corp., synthetic ammonia plant and the downstream urea and melamine facilities of Taiwan fertilizer Corp., and a few others.

CPDC is now producing CPL here using imported benzene or cyclohexane. A new CPL unit was mechanically completed in the second half of 2012 to double the capacity. A Nylon chip plant based on captive CPL was set up in early 1999. CGPC makes PVC with purchased VCM, while Hualon runs polyester and Nylon fiber manufacture.

## 2. The Mailiao Petrochemical Complex

This complex is located at central-west coast of Taiwan, and is one of the largest single petrochemical production zones not only in Taiwan but also in Asian region. This complex is also referred to as No. 6 naphtha cracker complex; it is owned by Formosa group. But Chang Chun group also share a small part and set up several petrochemical plants there. This complex is a complete petrochemical center integrated with refinery, naphtha cracker, industrial harbor, utility facility, and over dozens of petrochemical plants and logistics supplies.

This complex has undergone several expansions. Now the 4.5<sup>th</sup> phase expansion has just passed EIA. The major construction at this stage is focusing on high value synthetic rubbers.

Besides refineries, naphtha crackers, aromatics extraction units, major producers of middle stream petrochemicals inside this complex are as below:

### **Na Ya Plastics Corporation: (product name)**

DOP ; PA ; 2EH ; BPA ; EG ; ESO ; H2O2 ; INA ; EPOXY ; 1,4BG

### **Formosa Plastics Corporation:**

HDPE; LLDPE; LDPE/EVA; VCM; PVC; AA/AE; AN; ECH; MMA;  
MTBE; NaOH .

### **Formosa Chemicals and Fibre Corporation**

SM-1; SM-2; SM-3 ; PTA-1; PTA-2; PTA-3; PTA-4 ; Phenol/Acetone ; PP ; PC ;  
PS ;ABS .

**Dairen Chemical Corporation:**

VAM; Allyl alcohol

**Formosa- BP Corporation:**

Acetic Acid

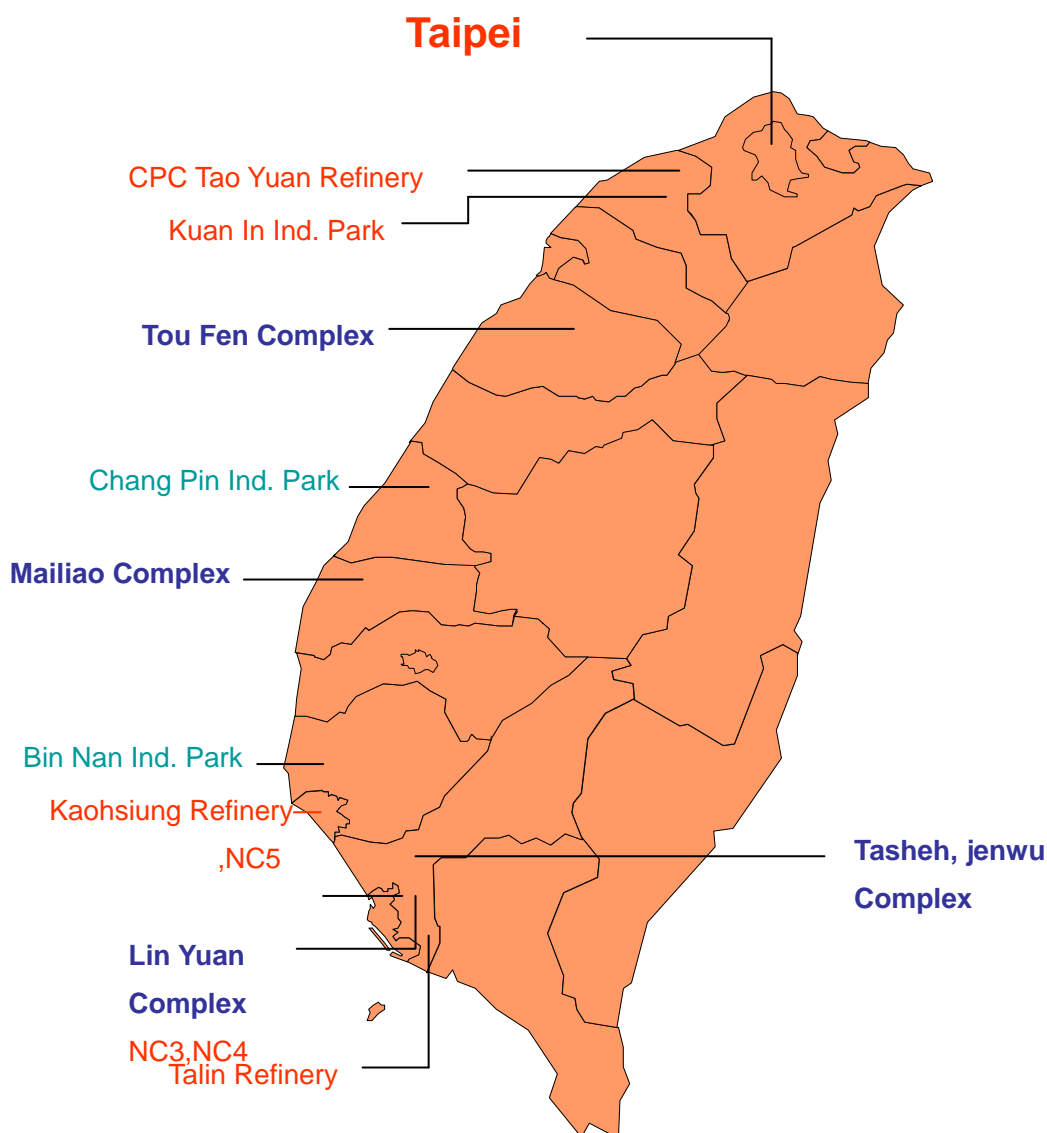
**3. The Ta-Sheh Petrochemical Complex**

This complex is located down south in Kaohsiung City. It is consisted of 10 producers, making synthetic rubbers, synthetic fiber intermediates, plastic materials, and some others.

**4. The Lin-Yuan Petrochemical Complex**

Consisted of 30 petrochemical producers, this complex is located in the southern part of Taiwan. It is the second largest petrochemical zone in this country. The products turned out here include nearly all categories of petrochemicals. Fig 5 illustrates major petrochemical complexes and plants in Taiwan.

Fig 5 Petrochemical Complexes in Taiwan



## Production and Foreign Trade of Petrochemicals

The production of different petrochemicals varied last year. The output of propylene, aromatics, and some monomers with versatile uses increased vs. 2011. The demand of those products was less affected by the economic recession. The production of major synthetic fiber intermediates decreased; this disclosed the fact of supply surplus. The decrease of most commodity plastics was brought about by demand slow down.

Table 1 shows the capacities of olefins and aromatics. The future expansions are also indicated. Table 2 provides the producers and capacities of plastics, synthetic rubbers, and synthetic fibers. Taiwan is among the large players of commodity plastics, synthetic rubbers and fibers intermediates. These petrochemicals are produced in Taiwan in large

volume. The exports are also huge enough, in addition to domestic consumption and conversion. Table 2 lists the capacities of these important petrochemical products. The producers are also indicated in abbreviations. For details, one may refer to the annual report 「Petrochemical Industry in Taiwan , ROC」 which updates once a year. This book is available from The Petrochemical Industry Association of Taiwan.

**Table 1 Capacities of Olefins and Aromatics**

Unit: 1,000mt

Product	Capacity (as of April, 2013)	Capacity after future expansion
<b>OLEFINS</b>		
Ethylene	3820	4420
Propylene	3471	1673
Butadiene	580	670
<b>AROMATICS</b>		
Benzene	1615	1823
Toluene	93	93
Meta-Xylene	100	100
Para-Xylene	2420	2420
Ortho-Xylene	660	660

**Table 2 Capacities and Expansions of major Petrochemicals**

Unit: 1,000MTA

Product	Producer	Capacity (As of 2013.4)	After Expansion	
			Total Capacity	Date Scheduled
<b>Synthetic Fibers Intermediates</b>				
CPL	CPDC	300		
AN	CPDC	2246		
	FPC	280		
PTA	CAPCO	2,120		
	FCFC	2,200		
	Oriental Petrochemical	900		
	TUNTEX	500		
EO	CMFC	53		
	OUCC	250		
EG	CMFC	130		
	Nan Chung	300		
	NAN YA	1,320		
	OUCC	250		
<b>PLASTICS</b>				
LDPE/EVA	USI	120		
	FPC	240		
	APC	100		



HDPE	FPC	566		
LLDPE/HDPE	USI	160		
	FPC	264		
PVC	FPC	1,301		
	CGPC	220		
	OCEAN	120		
PP	LCY	400		
	FCFC	510		
	FPC	400		
PS	CHI MEI	150		
	TAITA	230		
	KAO FU	100		
	GPPC CHEM	60		
	FCFC	320		
	ENG CHUAN	60		
	Others	309		
ABS	CHI MEI	1,000		
	TAITA	60		
	GPPC	120		
	FCFC	410		
	EASTERN	30		
PVA	CCP	120	130	2Q2012
PC	FCFC	200		
	CHIMEI-ASAHI	140		
Epoxy Resin	CCP	200		
	UPC	7		
	Nan Ya	220		
PVAC	CCP	22.5		
SAP	FPC	110		
POM	PTW	20		
	FPC	45		
<b>Synthetic Rubbers</b>				
SBR	Chi Mei	20		
	TSRC	100		
BR	Chi Mei	80		
	TSRC	55		
TPE	Chi Mei	30		
	ENG CHUAN	60		
	TSRC	55		
	LCY	190		
NBR	Nantex	20		

Table 3 through Table 6 provides the production and trade statistics of major petrochemical products in Taiwan in recent years. As mentioned above, the statistics figures show that for most products both production and trade were slowed down in the year of 2012. The petrochemical industry of Taiwan has been characteristic of very high export ratio. For commodity plastics, more than 70% of the production was exported. Local conversion tends to be shrinking resulted from the out-moving of downstream processors.

Table 3 Production and Trade Statistics of Olefins and Aromatics

Unit: MT

Product	Year	2009	2010	2011	2012	2012/2011 Change%
Ethylene	Production	3,851,877	3,929,135	3,522,138	3,478,448	-1.24
	Import	296,296	347,827	373,205	348,415	-6.64
	Export	143,676	164,806	100,105	123,129	23.00
Propylene	Production	2,881,105	2,976,013	2,600,717	2,696,817	3.70
	Import	281,888	343,379	419,244	388,646	-7.30
	Export	547,032	488,066	437,242	501,235	14.64
Butadiene	Production	527,016	576,593	500,604	481,880	-3.74
	Import	172,337	200,959	199,945	165,642	-17.16
	Export	110,158	116,000	122,740	86,383	-29.62
Benzene	Production	1,557,693	1,708,346	1,553,843	1,683,578	8.35
	Import	672,362	771,924	670,750	603,524	-10.02
	Export	-	-	-	30,000	#DIV/0!
Toluene	Production	39,025	166,973	22,982	26,731	16.31
	Import	143,620	222,078	168,974	242,956	43.78
	Export	17,443	146,420	8,395	18,491	120.26
	Production	2,460,628	2,731,197	2,496,345	2,594,550	3.93

Xylenes	Import	1,388,878	1,649,646	1,850,883	1,357,938	-26.63
	Export	694,967	662,269	808,982	838,963	3.71

Table 4 Production and Trade Statistics of Major Plastics materials

Unit: MT

Product	Year	2009	2010	2011	2012	2012/2011 Change%
LD/LLD/E VA	Production	661,280	690,508	571,033	499,252	-12.57
	Import	166,939	244,568	288,668	313,854	8.72
	Export	524,365	546,038	417,537	385,387	-7.70
HDPE	Production	577,976	544,142	519,860	469,559	-9.68
	Import	62,171	81,829	78,977	79,637	0.84
	Export	336,088	288,502	282,548	258,915	-8.36
VCM	Production	1,772,586	1,758,189	1,684,720	1,817,398	7.88
	Import	65,164	63,809	61,500	64,233	4.44
	Export	405,783	407,599	336,214	369,292	9.84
PVC	Production	1,415,914	1,432,356	1,410,642	1,510,378	7.07
	Import	22,964	29,100	24,345	20,199	-17.03
	Export	910,239	830,357	854,056	988,555	15.75
PP	Production	1,231,008	1,215,354	1,080,184	1,049,126	-2.88
	Import	75,724	89,104	135,498	157,327	16.11

	Export	796,813	755,745	661,569	646,615	-2.26
SM	Production	1,906,015	1,921,722	1,692,832	1,790,376	5.76
	Import	402,901	501,831	365,525	383,669	4.96
	Export	531,583	428,541	266,617	351,957	32.01
PS	Production	777,297	844,988	871,704	838,330	-3.83
	Import	10,001	13,076	13,964	10,539	-24.53
	Export	684,532	768,326	783,033	745,904	-4.74
ABS	Production	1,245,339	1,364,772	1,206,655	1,209,109	0.20
	Import	11,625	15,713	12,987	14,561	12.12
	Export	1,113,322	1,320,607	1,159,909	1,100,340	-5.14

Table 5 Production and Trade Statistics of Major Synthetic Fiber Intermediates

Unit: MT

Product	Year	2009	2010	2011	2012	2012/2011 Change%
CPL	Production	252,906	290,359	271,215	288,256	6.28
	Import	401,308	414,613	410,634	390,116	-5.00
	Export	298	-	369	7,452	1919.51
AN	Production	411,575	458,361	416,262	443,105	6.45
	Import	91,542	113,981	107,834	107,432	-0.37
	Export	93,605	102,820	113,438	155,337	36.94
PTA	Production	4,406,348	5,162,706	5,302,900	4,388,262	-17.25
	Import	80	12,144	1,008	2,543	152.28
	Export	2,171,769	2,679,279	2,960,983	1,938,284	-34.54
EG	Production	2,038,649	2,138,585	1,993,615	1,944,305	-2.47
	Import	239,789	271,772	278,893	273,159	-2.06
	Export	1,272,857	1,281,056	1,234,108	1,237,193	0.25

Table 6 Production and Trade Statistics of Major Synthetic Rubbers

Unit: MT

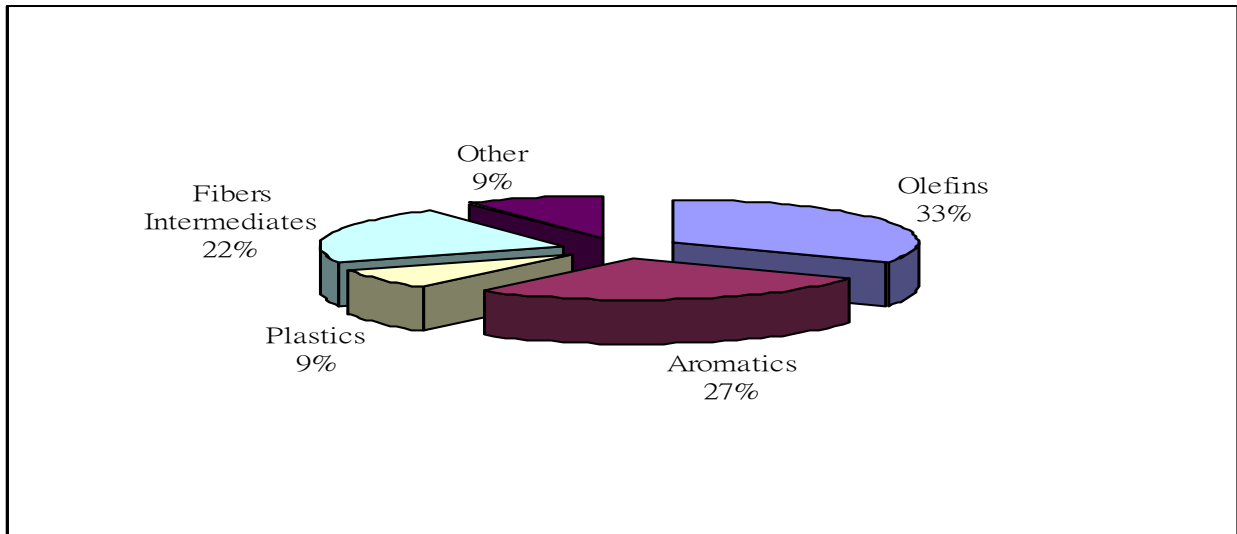
Product	Year	2009	2010	2011	2012	2012/2011 Change%
SBR	Production	93,197	100,828	104,238	92,911	-10.87
	Import	36,283	48,836	43,225	50,488	16.80
	Export	70,835	75,578	74,516	74,998	0.65
BR	Production	52,730	58,852	56,066	52,036	-7.19
	Import	15,646	22,388	18,109	23,268	28.49
	Export	58,677	61,942	61,568	57,001	-7.42
CB	Production	81,830	96,821	108,168	94,441	-12.69
	Import	46,667	80,475	64,508	75,564	17.14
	Export	34,865	38,636	41,673	40,607	-2.56

## The Domestic Petrochemical Consumption

The per capita petrochemical consumption of Taiwan, as counted by ethylene equivalent, was 94Kg in 2012, according to a report made by the Taiwanese government. This is the highest level in Asian region. This per capita petrochemical consumption is highly related to the per capita income of the country. It reflects a fact that petrochemical product makes contribution to enhancing the people's living standard.

The apparent consumption of petrochemicals, as compared to a year before, showed: olefins, - 1.53%; aromatics, - 5.00%; plastics, +2.25%; synthetic fiber intermediates, +0.57%; synthetic rubbers, - 6.87%; others, +2.99%. This demand analysis indicates that aromatics and rubbers are highly export-dependent, and the export shrinkage is just a sign of weak demand in foreign market. On the other hand, plastics and fibers are mostly consumed in everyday life, and their demand growth is positive and firm. The total production value of the Taiwanese petrochemical industry was 1.82 trillion NT\$ in 2012, slightly down from 1.92 trillion NT\$ a year before.

Fig 6 Domestic Demand Breakdown in 2012



## The Outlook

The industrial leaders realize that the following trends regarding the future development of Taiwanese petrochemical industry should be observed:

- Globalization---overseas investments
- Diversification---move to high tech fields and petrochemical-related sectors.
- Quality upgrading--production of high value-added products like engineering plastics and specialty chemicals
- Green production and sustained management

The Industry Development Bureau of the Taiwanese government has set principles concerning the policy and advice for the future development of petrochemical industry as below:

- Mild capacity expansion of upstream to sustain downstream needs and global trade
- Keep orderly domestic production to improve competitiveness
- Push up R & D and upgrade technology
- Promotion of high-value-added petrochemical production
- Enhance pollution control and industrial safety
- Promote energy saving and utilization efficiency

In view of the fierce anti-pollution protests against the petrochemical parks, the Taiwanese government has set a new policy of petrochemical industry development. This is basically to produce commodity petrochemicals in overseas sites and to make high value petrochemicals domestically. In other words, commodity petrochemical projects inside this country would hardly be permitted hereafter.

In light of this new policy, large volume petrochemicals will no longer to be made in

Taiwan. The MOEA set up an office at year end 2011 for the promotion of high value petrochemicals. The office has also completed plans for actions. It has selected more than 40 items for R & D and production in the first stage.

The vision of this new policy is to make Taiwan become an important operation center for high value petrochemicals in Asia region. This is also aiming at upgrading the competitiveness of the industry and to secure a reasonable balance between national economic development and environmental protection. A clear target has been set to achieve a total petrochemical industry production value of NT\$ 2.42 trillion by 2020, up from NTS1.82trillion in 2012. The rate of value addition would achieve 20%.

The outlook of Taiwanese petrochemical industry would be basically similar to that of others in the world. The key affecting factors are economical, environmental, and industrial scenarios. One of the primary issues is the development of super low cost shale gas which would bring about feedstock revolution and cost competition of petrochemical production. In near term, producers would also confront with some troubles that deteriorate product market, notably the American financial cliff, the European financial crisis, the growth shrinking of China, and the prolonged economic recession of Japan. In conclusion, there are still lots of challenges that the industry has to meet.