TAIWAN, REPUBLIC OF CHINA

The Petrochemical Industry in Taiwan

The Industry and the Economic Development

Last year (2011) was a year of drastic change, not only in the commercial world, but also in many other aspects. As it could be watched, many countries suffered economic recession and currency inflation. Among top economies, the US was plagued by financial difficulty, with national debt piled up, and unemployment boosted, reflecting in a sharp decrease of people's living standards. Japan faced the worst situation caused by a terrible earthquake and nuclear radiation that led to unprecedented disaster. Above all, the financial crisis of EU nations brought about widespread impacts. China, which has been powering the growth of world economy in recent years, was also slowing down. The economic developed regions, particularly America, Europe, and Japan，provided market for the products and services from developing countries including Taiwan. The stagnant business environments over these regions have heavily retarded trade flows.

The GDP growth of Taiwan in 2011 was 3.81%, ranking the lowest in Asia 4 little dragons. The petrochemical business cycle has been closely geared to the economic situations. Though the operations of most petrochemical producers were basically normal, the revenues were decreased about 20% at large. Formosa Group, one of the most noted enterprises in this country, suffered from a series of plant accidents; CPC Corp., on the other hand, recorded huge loss owing to the frozen oil prices as the government policy requested.

In Taiwan, as in other countries, particularly those developing economies, the petrochemical industry plays important role in economic achievements. Fig 1 shows the GDP growth in Taiwan in recent decade. Generally speaking, petrochemical production contributed nearly one third of the national economic performance.
Last year, 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$ 4.09 trillion dollars, while the total manufacturing sector created NT$14.5 trillion dollars. In addition, the production in overseas locations has also been on the rise.

Fig 1.Petrochemical Industry: A Major Contributor To Taiwan's Economy Growth

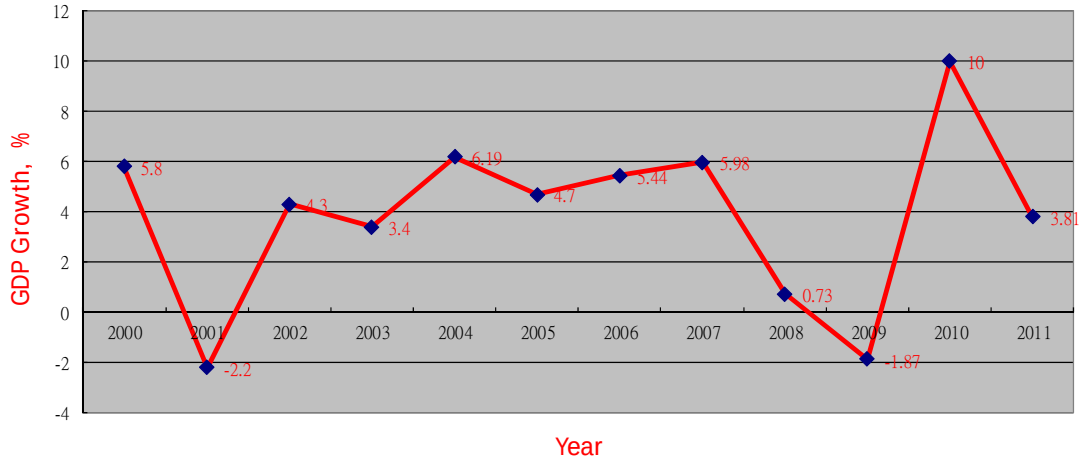
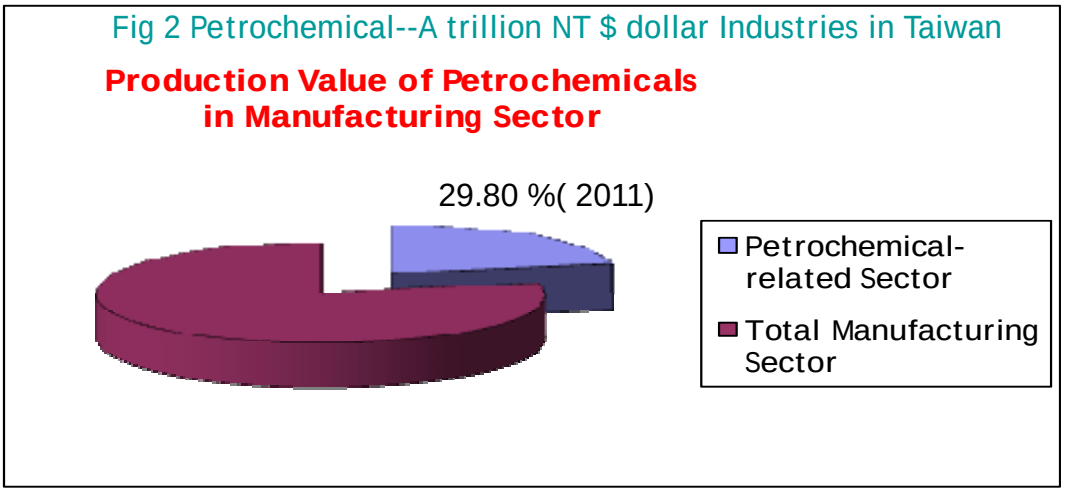


Fig 1 shows Taiwan's GDP peaked in 2010 when the economy had a robust recovery from prior recession. Most Taiwanese petrochemical producers enjoyed fairly satisfied profitability. In 2011, the business cycle slowed down along with the GDP decline. So last year the situation was just a rollover.

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

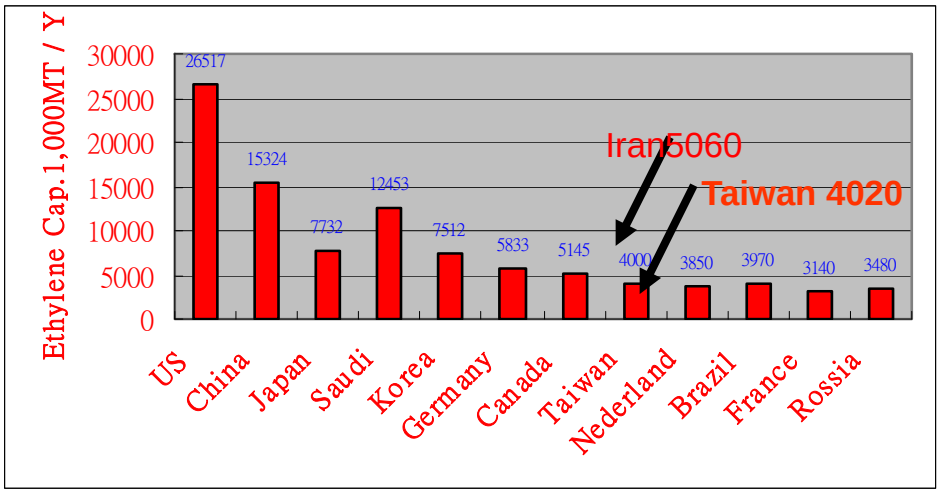


The Ethylene Capacity and Production

Since ethylene is the key material for petrochemical manufactures, the annual ethylene capacity is a vital indicator representing the scale of the petrochemical industry of a country or region. As Fig 3 shows, the petrochemical industry of Taiwan ranks 9th largest in the world in terms of annual ethylene capacity. However, with the rise of other new economies, this rank is being lagged behind. The anti-pollution protests from the local people's communities have been robust in recent years; any new constructions of

petrochemical facilities become impossible. Hence, new capacity expansions have been heavily restrained and retarded. New investments in this industry can only find opportunities in foreign countries.

Fig 3 Ethylene Capacity Ranks 9th Largest in the World



One of the best examples is the sudden halt of KuoKwang Petrochemical Technology Project (KKPT), a mega plan launched in this country in past 10years. This huge project is consisted of refinery, naphtha cracker and tenths of downstream factories. It has been planned for 5 years, injecting quite a big amount of money. The 1st phase of this project is to produce 1.2 MMMT of ethylene using captive naphtha as feedstock. This is referred to as an important milestone for the further development of the Taiwanese petrochemical industry. Unfortunately, it is dead.

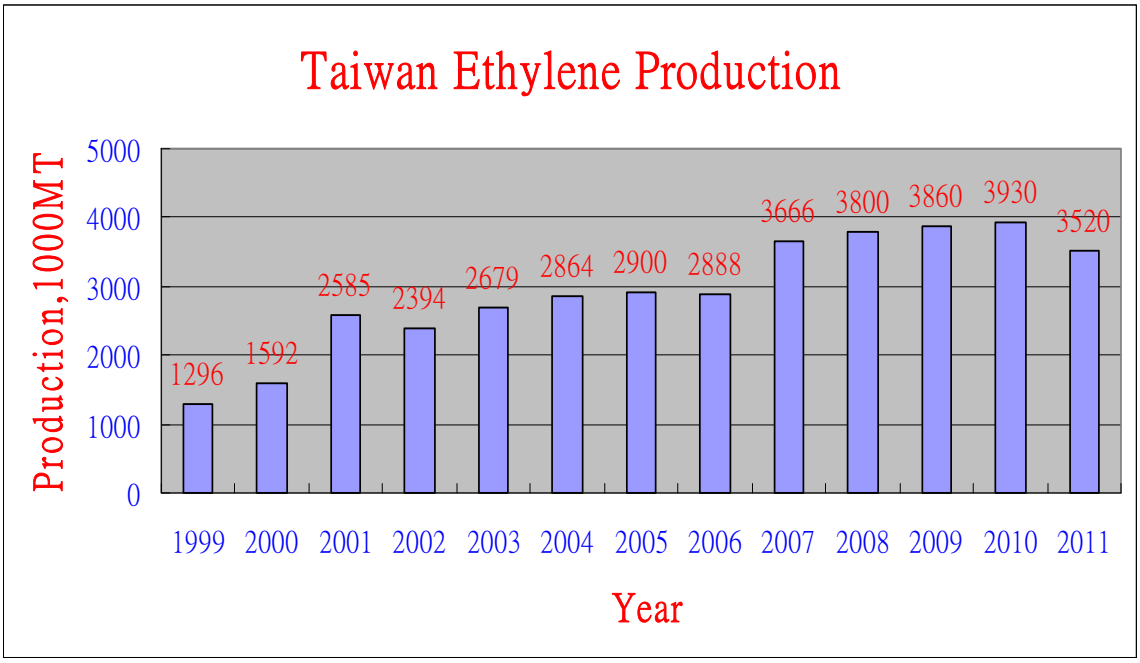
It was highly regrettable that this mega project of Kuokwang Petrochemical Technology was shelved. President Ma ordered to halt in response to the anti-pollution protests of environmentalists. A new policy by the ministry of economic affairs (MOEA) which called for producing fine chemicals domestically and commodity products overseas was then issued. This means that 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. Its future development is unpredictable.

The production of ethylene totaled 3.52 MMMT in 2011, a 10.36% decrease over the previous year. This was the lowest record since 2007. Total ethylene demand was also down 7.71%. It could be attributed to the low operation rates of naphtha crackers caused by emergent shutdowns. Production and trade of petrochemicals were pretty good in year beginning that sustained the prior booming demand. The business deteriorated in the 2nd half of the year due to the slow down of export when China's consumption diminished.

Fig 4 shows the ethylene production statistics in Taiwan over the past decade. Clearly, the figure displayed a big jump after the year of 2000 when the Formosa Group joined in as a giant player.

Currently, there are 6 ethylene plants under running, with a total capacity of 4.015MMMT 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



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 3rd naphtha cracker with an ethylene capacity of 1.20MMMTwas also on stream in May 2007. In addition, FPCC's No 1 cracker completed debottlenecking to raise capacity in year-end 2002.

Out of the current 4.015MMMT of ethylene capacity, FPCC account for 2.935MMMT or 73% of the total, while CPC shares 27%.

CPC is revamping its NC 3 to raise annual capacity of ethylene to 800,000MT. This is a build-and-scrap project. It has been carrying out smoothly, and is now close to mechanical completion. The scheduled time of commissioning would be Q1, 2013. The old NC3 which has been running for more than 30 years is going to be phased out upon the start-up of the new one.

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 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 5th phase expansion has changed partly to focus on the refinery and petrochemical intermediates; meanwhile, to add high-value products. It is waiting for final governmental approval.

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 and capacity in 1,000mt/y)

DOP (373); PA (228); 2EH (150); BPA (420); EG (1,320); ESO (20); H2O2 (20); INA (115); EPOXY (134); 1,4BG (100).

Formosa Plastics Corporation:

HDPE (350); LLDPE (264); LDPE/EVA (240); VCM (800);
PVC (494); AA/AE (108/154); AN (280); ECH (100); MMA (98);
MTBE (174); NaOH (1,233).

Formosa Chemicals and Fibre Corporation

SM-1(250); SM-2(350); SM-3 (600); PTA-1(550); PTA-2(550); PTA-3(700); PTA-4 (400);
Phenol/Acetone (400/246); PP (510); PC (200); PS (320);
ABS (410).

Dairen Chemical Corporation:

VAM(650); AAL (285).

Formosa- BP Corporation:

Acetic Acid (300)

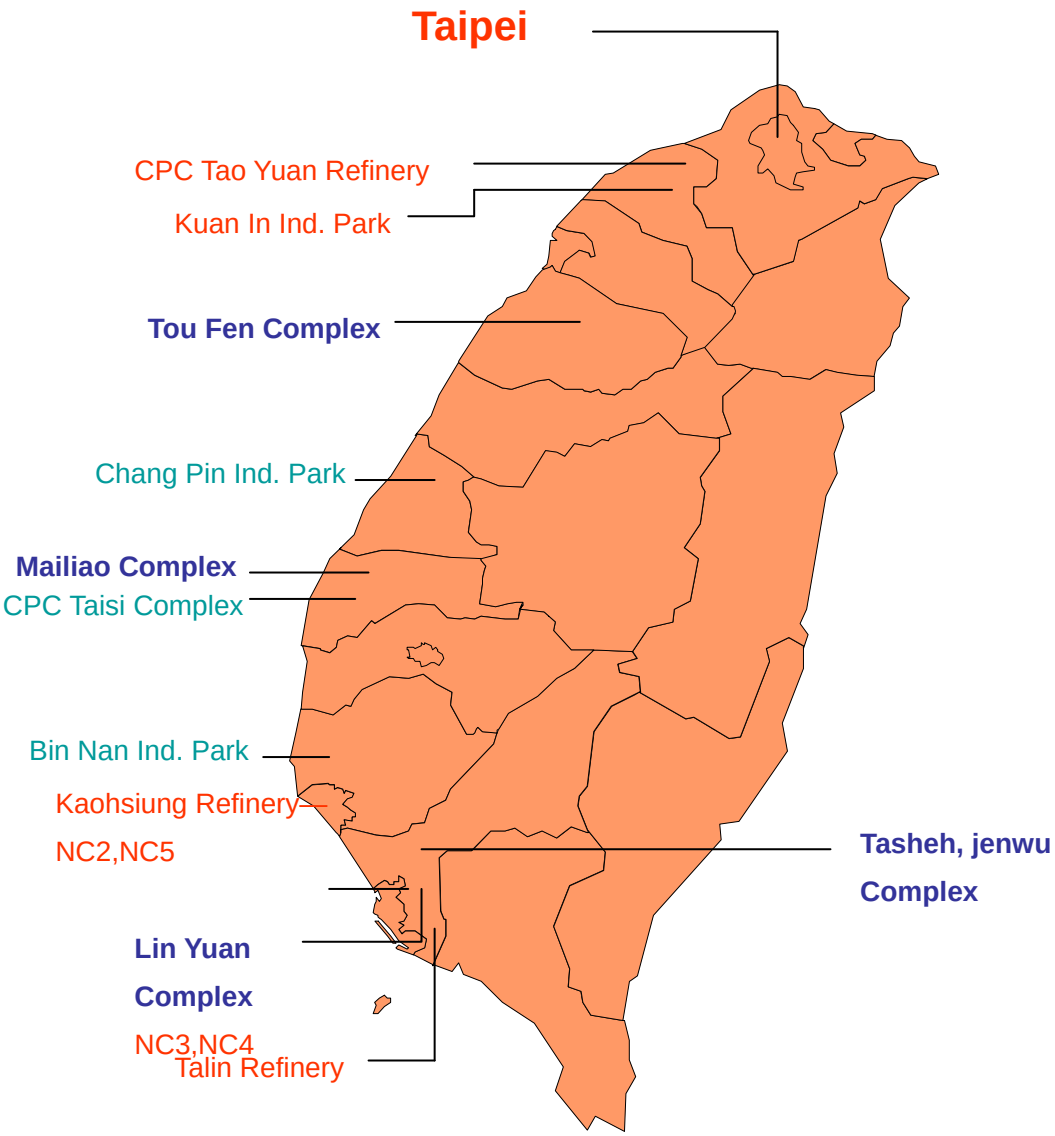
3. The Ta-Sheh Petrochemical Complex

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 industrial 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 output of most petrochemical intermediates decreased along with the short supply of olefins and aromatics last year. Roughly, 5-10% for monomers, 10-15% for polymers, versus that of 2010.

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, 2012)	Capacity after future expansion
OLEFINS		
Ethylene	4015	4785
Propylene	3093	3989
Butadiene	620	755
AROMATICS		
Benzene	1772	1862
Toluene	93	
Meta-Xylene	0	100
Para-Xylene	2280	2420
Ortho-Xylene	610	660

Table 2 Capacities and Expansions of major Petrochemicals

Unit: 1,000MTA

Product	Producer	Capacity (As of 2012.4)	After Expansion	
			Total Capacity	Date Scheduled
Synthetic Fibers Intermediates				
CPL	CPDC	280		
AN	CPDC	190		
	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		
PLASTICS				
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		
	BC CHEM	62		
	KAO FU	100		
	GPPC CHEM	30		
	FCFC	320		
	ENG CHUAN	60		
	Others	309		
ABS	CHI MEI	1,000		
	TAITA	60		
	GPPC	100	**140**	**1Q2012**
	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	40	**110**	**2012** 年
POM	PTW	20		
	FPC	45		
Synthetic Rubbers				
SBR	Chi Mei	20		
	TSRC	100		
BR	Chi Mei	80		
	TSRC	54		
TPE	Chi Mei	30		
	ENG CHUAN	60		
	TSRC	54		
	LCY	190		
NBR	Nantex	24		

Table 3 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 2011. 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 major Petrochemicals

Unit: MT

Product	Year	2008	2009	2010	2011	2011/2010 change%
Ethylene	Production	3,622,636	3,851,877	3,929,135	3,522,138	-10.36
	Import	342,306	296,296	347,827	373,205	7.30
	Export	14,330	143,676	164,806	100,105	-39.26
Propylene	Production	2,661,760	2,881,105	2,976,013	2,600,717	-12.61
	Import	308,714	281,888	343,379	419,244	22.09
	Export	590,560	547,032	488,066	437,242	-10.41
Butadiene	Production	513,371	527,016	576,593	500,604	-13.18
	Import	143,558	172,337	200,959	199,945	-0.50
	Export	96,000	110,158	116,000	122,740	5.81
Benzene	Production	1,550,229	1,557,693	1,708,346	1,553,843	-9.04
	Import	427,613	672,362	771,924	670,750	-13.11
	Export	-	-	-	-	#DIV/0!
Toluene	Production	15,562	39,025	166,973	22,982	-86.24
	Import	264,619	143,620	222,078	168,974	-23.91
	Export	9,967	17,443	146,420	8,395	-94.27
Xylenes	Production	2,463,990	2,460,628	2,731,197	2,496,345	-8.60
	Import	1,131,851	1,388,878	1,649,646	1,850,883	12.20
	Export	818,289	694,967	662,269	808,982	22.15
LD/LLD/EVA	Production	622,786	661,280	690,508	571,033	-17.30
	Import	169,041	166,939	244,568	288,668	18.03
	Export	432,050	524,365	546,038	417,537	-23.53
HDPE	Production	511,606	577,976	544,142	519,860	-4.46
	Import	80,824	62,171	81,829	78,977	-3.49
	Export					-2.06

		271,303	336,088	288,502	282,548	
VCM	Production	1,632,573	1,772,586	1,758,189	1,684,720	-4.18
	Import	72,152	65,164	63,809	61,500	-3.62
	Export	325,307	405,783	407,599	336,214	-17.51
PVC	Production	1,386,461	1,415,914	1,432,356	1,410,642	-1.52
	Import	22,564	22,964	29,100	24,345	-16.34
	Export	811,332	910,239	830,357	854,056	2.85
PP	Production	1,178,601	1,231,008	1,215,354	1,080,184	-11.12
	Import	77,482	75,724	89,104	135,498	52.07
	Export	741,251	796,813	755,745	661,569	-12.46
SM	Production	1,679,391	1,906,015	1,921,722	1,692,832	-11.91
	Import	429,778	402,901	501,831	365,525	-27.16
	Export	574,998	531,583	428,541	266,617	-37.78
PS	Production	637,825	777,297	844,988	871,704	3.16
	Import	13,221	10,001	13,076	13,964	6.79
	Export	586,599	684,532	768,326	783,033	1.91
ABS	Production	1,129,858	1,245,339	1,364,772	1,206,655	-11.59
	Import	14,681	11,625	15,713	12,987	-17.35
	Export	1,084,253	1,113,322	1,320,607	1,159,909	-12.17
MMA	Production	160,788	175,448	194,517	173,537	-10.79
	Import	90,799	93,447	133,008	135,187	1.64
	Export	59,682	41,775	47,617	54,048	13.51
Melamine	Production	10,046	6,599	10,796	8,646	-19.91
	Import	4,033	1,983	959	2,507	161.42
	Export	124	432	1,241	299	-75.91
	Production	215,820	252,906	290,359	271,215	-6.59

CPL	Import	421,283	401,308	414,613	410,634	-0.96
	Export	173	298	-	369	#DIV/0!
AN	Production	359,502	411,575	458,361	416,262	-9.18
	Import	135,847	91,542	113,981	107,834	-5.39
	Export	121,204	93,605	102,820	113,438	10.33
PTA	Production	4,095,844	4,406,348	5,162,706	5,302,900	2.72
	Import	-	80	12,144	1,008	-91.70
	Export	1,986,202	2,171,769	2,679,279	2,960,983	10.51
EG	Production	2,013,642	2,038,649	2,138,585	1,993,615	-6.78
	Import	243,036	239,789	271,772	278,893	2.62
	Export	1,432,129	1,272,857	1,281,056	1,234,108	-3.66
SBR	Production	101,992	93,197	100,828	104,238	3.38
	Import	36,786	36,283	48,836	43,225	-11.49
	Export	72,149	70,835	75,578	74,516	-1.41
BR	Production	50,377	52,730	58,852	56,066	-4.73
	Import	16,671	15,646	22,388	18,109	-19.11
	Export	56,980	58,677	61,942	61,568	-0.60
CB	Production	93,988	81,830	96,821	108,168	11.72
	Import	53,949	46,667	80,475	64,508	-19.84
	Export	30,326	34,865	38,636	41,673	7.86
PA	Production	227,150	262,993	244,263	177,985	-27.13
	Import	3,114	3	4	5	25.00
	Export	59,258	69,829	86,389	67,064	-22.37
DOP	Production	188,854	224,300	122,459	96,870	-20.90
	Import	52	48	96	160	66.67
	Export	108,075	173,896	84,555	45,845	-45.78

PPG	Production	55,533	48,774	51,550	54,200	5.14
	Import	38,900	24,337	51,922	43,205	-16.79
	Export	17,202	25,739	39,189	65,857	68.05
MeOH	Production	-	-	-	-	#DIV/0!
	Import	978,524	945,143	1,074,061	1,082,784	0.81
	Export	7,202	2,833	2,925	3,426	17.13
VAM	Production	453,774	405,627	472,089	536,875	13.72
	Import	8,401	18,469	21,810	18,405	-15.61
	Export	199,072	172,967	191,386	215,198	12.44
PVA	Production	83,645	75,252	99,509	95,735	-3.79
	Import	1,660	1,388	2,050	2,097	2.29
	Export	67,611	63,359	83,363	77,357	-7.20
AB	Production	84,219	85,817	90,659	104,326	15.08
	Import	646	547	112	114	1.79
	Export	64,025	67,410	77,471	76,241	-1.59

The Domestic Petrochemical Consumption

The per capita petrochemical consumption of Taiwan, as counted by ethylene equivalent, was 121.9Kg in 2011, 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 total demand of upstream petrochemicals in Taiwan last year, as counted by those figures presented in Table 3, amounted to 24.77 MMMT, with a break down as: olefins 29%，aromatics 24%, plastics 22%, synthetic fibers intermediates 18%, synthetic rubbers 1%, and other industrial chemicals 6%. The apparent domestic demand equals to production + import – export. This sum of apparent demand in 2011 was 6.26% less versus a year ago.

Exports have been the major part of Taiwanese petrochemical supplies. Taiwan's

petrochemical industry is characteristic of its high export ratio. Over 70% and even 90% of the commodity plastics and synthetic fibers materials produced in Taiwan was exported, mostly to China. Quite a many of Taiwanese petrochemical firms set up production facilities in China and obtain raw material supplies from Taiwan. Accordingly, Taiwan has been among the biggest players in the regional petrochemical markets. For commodity plastics and fiber materials, Taiwan's market share ranks No1 or No.2 in China market---the worldwide biggest absorber.

More than 30 years ago, Taiwan was a world processor, much earlier than China. Taiwan was once referred to as the kingdom of end products like shoes, umbrellas, toys, garments, bags, films, etc. Huge tonnage of petrochemical materials was imported for processing export. Later on, after the year of 1990, Taiwan shifted its position from polymer importer to exporter when China took over the role of being a world processor.

Since then the export of petrochemical raw materials has been accelerating at a fast pace. At the same time, the domestic consumption tends to be shrinking. The reason behind the high export ratio and the shrunk domestic consumption of petrochemical raw materials nowadays is that a lot of the downstream processing plants have been out-moved because of labor cost. These processors have relocated their production facilities to overseas countries particularly to China, where labor supply is abundant and the wage is relatively lower. Taiwan continues to supply raw materials for their needs.

The Outlook

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

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

- Globalization---overseas investments
- Diversification---move to high tech fields
- Quality upgrading--production of high value-added products like engineering

plastics and specialty chemicals

- Green production and sustained management

Still, one thing worth to note is the environmental problem. Petrochemical producers have been worrying about the ever strict environmental controls set by the government. In particular, waste water, VOC, CO2 etc., controls continue to be strengthened. New plant operation permits have been pending. Existing plants have been claimed by the neighboring residents to move or scrap. The debates by the two major political parties in last presidential election both revealed that petrochemical capacity expansions should be restrained. These are nightmares of the Taiwanese petrochemical industry.

However, one may just look with an optimistic eye. In view of the wide uses of petrochemical products in various fields of men's life, the petrochemical industry should further grow along with the national and the world economy. In the year of 2012, the global economy is still full of uncertainties that would affect market demand. However, huge capacity additions have been announced especially in America, Middle East, Central America, and China, symbolizing optimistic sides for the industry.