REPUBLIC OF CHINA

The Petrochemical Industry in Taiwan

The Global Economy and the Industry

The global economy has been in bad recession since the second half of 2008 resulted from the financial crisis. The world average GDP growth was only 0.6% in 2008; it rebounded to 5% in 2009. Looking at the development of 2010, everything seemed to back to normal，the whole situation has been directing toward a better recovery. The world GDP is hopefully to keep at 4-5% as a whole in the near period.

The US stood at its super power status, remaining as the strongest economy in the world. China, the newly emerged economy, did not suffer much impact from the worldwide recession, and continued its GDP growth at considerable fast pace. In 2010 China superseded Japan as the world 2nd largest economic power. This was a big development that received wide attention. In the past decade, China has been successfully and ambitiously playing the role of the so-called「world processor」. Various China-made goods are seen in most parts of the world. The fact is that China has concentrated on the foreign trade expansions, depending on its low cost manufacture. The huge labor supply and the low wage levels brought about by a 1.3 billion population also contributed a lot. On the contrary, strong or even accelerated economic growth should be pursued to sustain the survival of such a huge population. The petrochemical consumption is directly proportional to the GDP growth, since petrochemicals are used not only in different phases of people's life, but also in a wide range of related industries. A booming economy may surely build up market strength for petrochemical products.

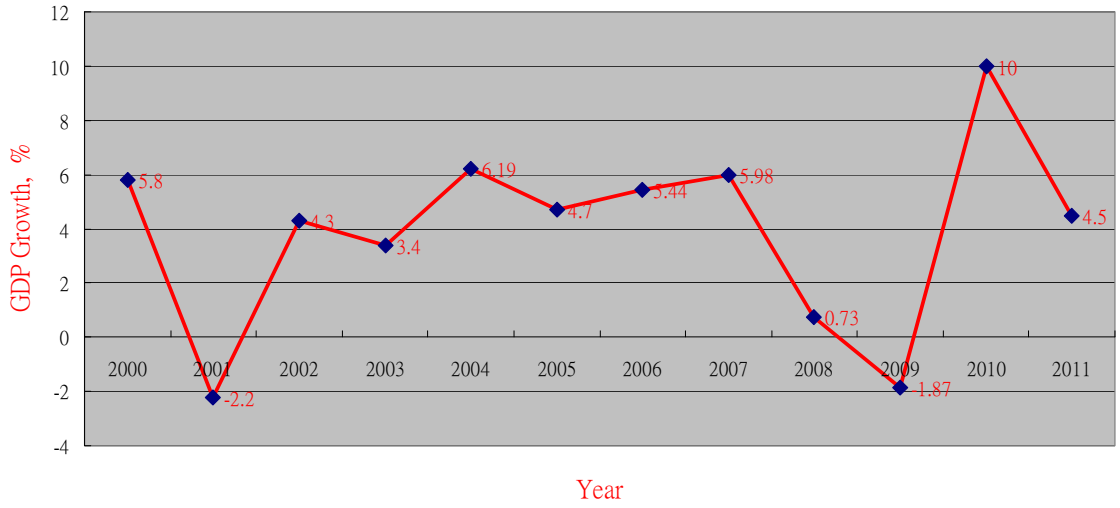
The Contribution of Petrochemical Industry to Taiwan Economy

The Taiwan economic development basically follows the general trend of the world. The 2010 actual GDP growth raised to 10% from a bottom of -2% recorded in 2009. However, this is not the true situation; the two-year average was only 4%. In other word, the Taiwanese economic growth last year was dissatisfied. This could be attributed to a variety of political, social, and environmental factors. Fig 1 shows the GDP growth of Taiwan in recent decade. The GDP growth of Taiwan in 2011 is forecast to be around 4.5%.

Today, Taiwan is a country with excessive democracy and individualism. Accordingly, lots

of the public affairs can hardly reach consensus. There are always too many opinions. A good example is the opposition expressed to the establishment of large scale petrochemical projects.

Fig 1 The GDP Growth of Taiwan in recent decade



The foreign trade has been a driving motor for the Taiwanese economy advancement. As Taiwan is a country short in natural resources, the export trade has played a primary role in creating the national economic growth. In 2010 the total volume of export were seen a little leap, ranking 16th largest in the world, according to a preliminary statistics issued recently by the WTO. The aggregate exports amounted to US$ 274.6 billion, and accounted for 1.9% of the world total. Taiwan's rank has again returned from No. 17 in 2009 and No. 18 in 2008. Nevertheless, this foreign trade record has still fallen behind that of the Asia Four Little Dragons, despite that a series of worldwide trade promotion activities were launched by the international trade authority of the Taiwanese government. The record in 1Q 2011 seemed better, both import and export were on the rise. One thing worthy to note is that the petrochemical products have been accounting for about 30% of the total Taiwanese exports.

The government of Taiwan, the Ma administration, has implemented a handful of measures for the sake of economic stimulation since it was in power three years ago. The Ma administration has strongly encouraged investing in six newly emerging industries and services sectors; namely:

- ◯ Green energy
- ◯ Tourism
- ◯ Medical care

◯ Advanced agriculture
◯ Cultural innovation
◯ Biotechnology

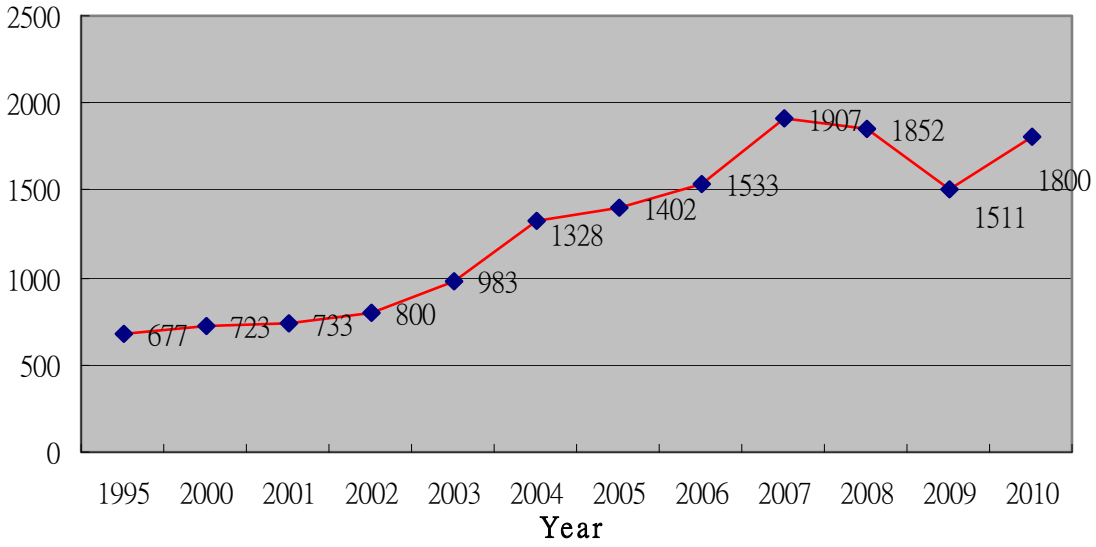
To explain a little more, the green energy comprises solar energy, LED, wind power, biomass fuels, electric cars, hydrogen energy and fuel cell.

Overview of Taiwanese Petrochemical Industry

In the year of 2010 most of the Taiwanese petrochemical producers enjoyed normal business operations; the average plant capacity utilization was above 85%, and the profitability was fairly good. As reflected from the company performance, the industry has entirely gotten rid of the global economic recession. Taiwan is now the 9th largest petrochemical -producing country in the world; however, further capacity expansions have been restrained. Last year various progresses were seen. The industry carried out product upgrading, energy conservation, CO2 reduction, and the development of renewable energy as well as green manufactures. These progresses have been achieved through the joint effort of the government and the industry.

Fig 2.the production value of Taiwanese petrochemical industry

Unit: NT$ billion



In view of the new capacity expansions, the No. 3 cracker revamping of CPC has been widely observed. After several years of controversial environment impact assessment, this project had been started. It is a build-and scrap case. Possibly the new cracker would be completed and commissioned in mid-2012. This project will boost the cracker ethylene capacity to 800,000Mt/y to solve the supply deficit of basic petrochemicals in southern

Taiwan.

Regarding the planned new investments, the Kuo Kuang Petrochemical Technology Project (KKPTP) and the 5th phase expansion project of Formosa's No. 6 cracker, have also received close attention. The EIA process for KKPTP has been proceeding for a long time, and the conclusion is still highly uncertain. The KKPTP is consisted of refinery, naphtha cracker, aromatics units, and tenths of intermediate plants. This is an important mile stone for further development of the petrochemical industry in this country. The KKPTP is expected to be able to make major contribution to the national economy. It might also be a substitute to No. 5 cracker and Kaohsiung refinery which are planned to be scrapped .Environmentalists have strongly condemned, demanding to suspend the project. The future about KKPTP is undetermined. As for the case of Formosa, the project detail has been revised, and the EIA date of completion is also unclear.

Unfortunately, the KKPTP has been suspended by the Taiwanese government on this April 22, in a response to the anti-pollution protest.

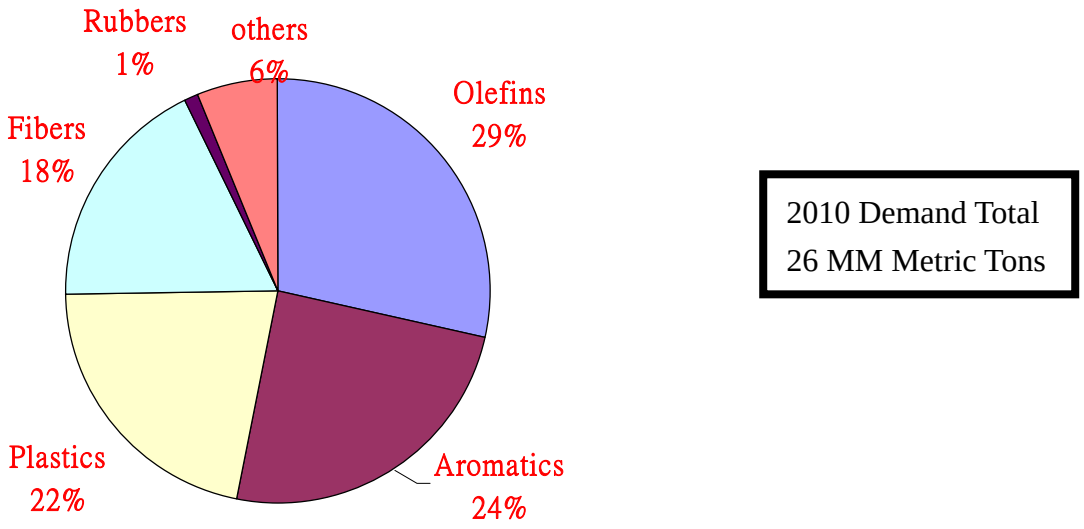
Table1 the proposed KKPTP products

Product	Capacity (1,000mt/y)	Product	Capacity (1,000mt/y)
Acetic acid	500	MTBE	285
α-olefin	250	Cumene	260
EG	600	Phenol	200
LLDPE/EVA	500	BPA	200
AN	250	MMA	100
PP	450	PTA	700
Acrylic acid/ester	160	Dicyclopentadiene	100
2EH	150	BDO	140
SM	600	Isoprene	50
SBR	150	VAM	300
Alkyl benzene	100	MA	100

Taiwan's ethylene production amounted to 3.93 million MT in 2010, an all-time high figure and equaled to an operation rate of 98.3%. Naphtha crackers were nearly under full operation last year, although there were several shutdown maintenances and accidents. The per capita petrochemical consumption of Taiwan, as counted by ethylene equivalent, was 55Kg, according to a report. This is the highest level in Asian region.

The total demand of upstream petrochemicals in Taiwan last year was 26 million MT, with a break down as: olefins 29%，aromatics 24%, plastics 22%, synthetic fibers intermediates 18%, synthetic rubbers 1%, and others 6%. The demand is consisted of domestic consumption and exports. 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. Fig 3 shows the details. 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.

Fig 3 Basic Petrochemical Materials Demand in Taiwan in 2010



Taiwan's per capital annual consumption of petrochemical product (counted as ethylene equivalent) is the highest in Asia region. It is 54.7 kg / head, followed by Korea 82.4, Singapore 57.5, Malaysia 41.7, Japan 34.3, Thailand 23.5, China 18.5, Viet Nam 8.0, Indonesia 5.1 and India 3.7, according to a research report released recently. The basic factor for such per capita consumption is said to be related to the population, the buying power, and the living standard.

Taiwan used to be a world processor, 30 year earlier than China .The reason behind the high export ratio 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 where labor supply is abundant

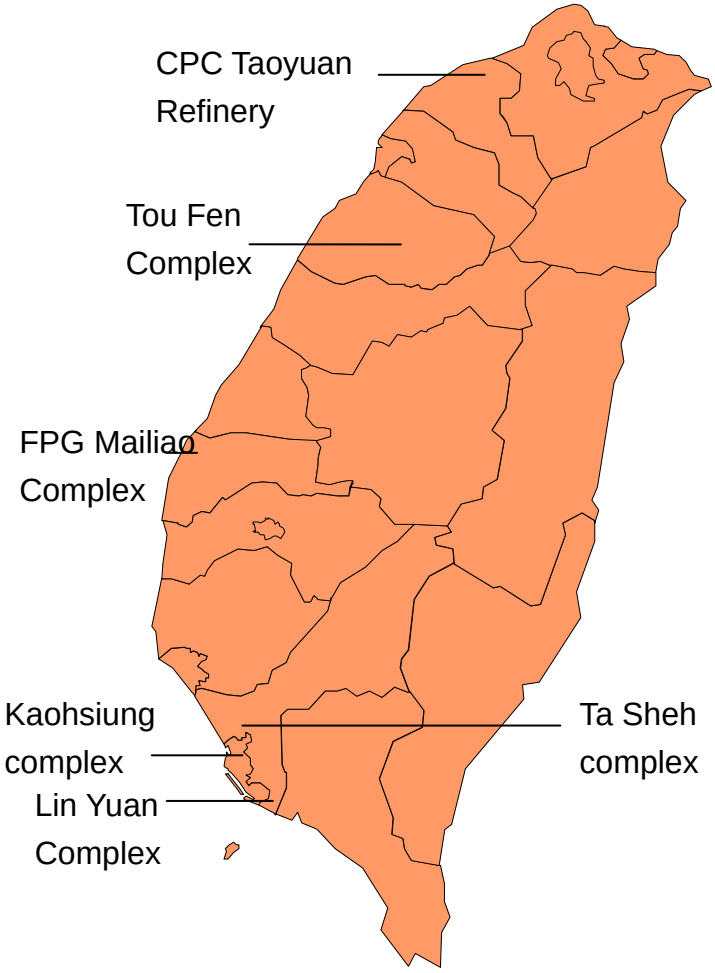
and the wage is relatively lower. Taiwan continues to supply raw materials for their needs.

Petrochemical Complexes and Upstream Plants

Fig 4 shows the petrochemical complexes in Taiwan. There are two producers of olefins and aromatics, i.e, CPC Corporation, Taiwan (CPC) and Formosa Petrochemical Corporation (FPCC). These are two giants in the Taiwanese petrochemical industry. Presently, CPC and FPCC are producing olefins and aromatics based mainly on the captive feed stocks from their refineries.

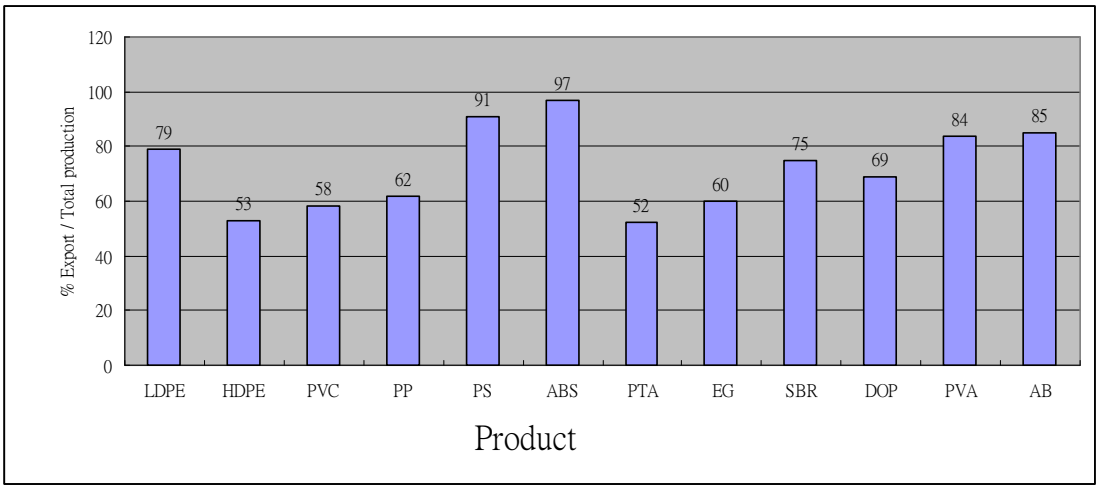
CPC owns 3 naphtha crackers (NC 3, NC 4, NC 5) and 4 aromatics units, which have been operating for years, while FPCC's NO.1, NO.2 naphtha crackers were started up in 1998 and 2000 respectively, and a 3rd naphtha cracker was added in May,2007.

Fig 4 LOCATIONS OF PETROCHEMICAL COMPLEXES



The current ethylene nameplate capacity in Taiwan is 4.015 million metric tons, in which CPC owns 1.08 million metric tons and FPCC hold the majority of 2.935 million metric tons.

Fig 5 Export % VS Total Production



As for aromatics, CPC is now operating 4 aromatics extraction units (No.3-6). The old 2 units (No.1-2) had been scrapped. The aggregate annual capacities MT/y) are: Benzene, 494,000; Toluene, 78,600; mixed xylene, 12,400. In addition, CPC owns 3 xylene separation plants, with a total capacity of OX 130,000 MT and PX 560,000 MT. The second aromatics maker in Taiwan is Formosa Chemical & Fibre Corporation (FCFC). The first of its 2 aromatics extraction units came on stream in 1Q 1999，using naphtha and pyrolysis gasoline as feed stocks. A 3rd aromatics unit was added in middle 2007.

Table 2 Capacities of olefins and aromatics

Unit: 1,000mt

Product	Capacity (as of April, 2011)	Capacity after future expansion
OLEFINS		
Ethylene	4015	4785
Propylene	3093	4089
Butadiene	620	755
AROMATICS		
Benzene	1772	1862
Toluene	93	
Meta-Xylene	0	100
Para-Xylene	2280	2420
Ortho-Xylene	610	660

Plastics, Rubbers and Fibers Intermediates

Major commodity plastics, synthetic rubbers and fibers intermediates are produced in Taiwan in large volumes. However, less capacity expansion has been seen in recent years. Table 3 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 3 Capacities and expansions of major petrochemicals

Unit: 1,000MTA

Product	Producer	Capacity (As of 2011.4)	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	1,540		
	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		

Production and Trade of major Petrochemicals

Table 4 provides the production and trade statistics of major petrochemical products in Taiwan in recent years. A general trend is clear for most products, both the production and the trade figures reveal that the sales and exports as well as imports have been on the way to rebounding. The business was hurt a little bit in 2008/2009 while the global financial crisis was prevailing.

Table 4 Production and trade statistics of major petrochemicals

Unit: MT

Product		2007	2008	2009	2010
Ethylene	Production	3,665,950	3,622,636	3,851,877	3,929,135
	Import	423,360	342,306	296,296	347,827
	Export	8,987	14,330	143,676	164,806
Propylene	Production	2,835,072	2,661,760	2,881,105	2,976,013
	Import	278,306	308,714	281,888	343,379

	Export	373,993	590,560	547,032	488,066
Butadiene	Production	521,453	513,371	527,016	576,593
	Import	138,738	143,558	172,337	200,959
	Export	77,280	96,000	110,158	116,000
Benzene	Production	1,605,683	1,550,229	1,557,693	1,708,346
	Import	678,285	427,613	672,362	771,924
	Export	-	-	-	-
Toluene	Production	35,825	15,562	39,025	166,973
	Import	340,737	264,619	143,620	222,078
	Export	11,717	9,967	17,443	146,420
Xylenes	Production	2,368,172	2,463,990	2,460,628	2,731,197
	Import	1,366,745	1,131,851	1,388,878	1,649,646
	Export	352,809	818,289	694,967	662,269
LD/LLD/EVA	Production	700,346	622,786	661,280	690,508
	Import	172,120	169,041	166,939	244,568
	Export	521,731	432,050	524,365	546,038
HDPE	Production	577,454	511,606	577,976	544,142
	Import	84,516	80,824	62,171	81,829
	Export	286,281	271,303	336,088	288,502
VCM	Production	1,810,273	1,632,573	1,772,586	1,758,189
	Import	97,300	72,152	65,164	63,809
	Export	362,827	325,307	405,783	407,599
PVC	Production	1,512,226	1,386,461	1,415,914	1,432,356
	Import	33,046	22,564	22,964	29,100
	Export	819,534	811,332	910,239	830,357
PP	Production	1,261,627	1,178,601	1,231,008	1,215,354
	Import	78,058	77,482	75,724	89,104
	Export	837,630	741,251	796,813	755,745
		1,824,424	1,679,391	1,906,015	1,921,722

SM	Production				
	Import	560,405	429,778	402,901	501,831
	Export	392,961	574,998	531,583	428,541
PS	Production	760,573	637,825	777,297	844,988
	Import	17,376	13,221	10,001	13,076
	Export	675,588	586,599	684,532	768,326
ABS	Production	1,324,351	1,129,858	1,245,339	1,364,772
	Import	21,826	14,681	11,625	15,713
	Export	1,227,773	1,084,253	1,113,322	1,320,607
MMA	Production	190,064	160,788	175,448	194,517
	Import	95,443	90,799	93,447	133,008
	Export	56,521	59,682	41,775	47,617
Melamine	Production	9,620	10,046	6,599	10,796
	Import	3,347	4,033	1,983	959
	Export	1,244	124	432	1,241
CPL	Production	256,614	215,820	252,906	290,359
	Import	463,591	421,283	401,308	414,613
	Export	904	173	298	-
AN	Production	451,407	359,502	411,575	458,361
	Import	153,883	135,847	91,542	113,981
	Export	138,705	121,204	93,605	102,820
PTA	Production	4,437,153	4,095,844	4,406,348	5,162,706
	Import	-	-	80	12,144
	Export	2,127,450	1,986,202	2,171,769	2,679,279
EG	Production	1,795,131	2,013,642	2,038,649	2,138,585
	Import	196,480	243,036	239,789	271,772
	Export	1,176,648	1,432,129	1,272,857	1,281,056
SBR	Production	111,756	101,992	93,197	100,828
	Import	41,942	36,786	36,283	48,836
	Export				

		72,559	72,149	70,835	75,578
BR	Production	54,146	50,377	52,730	58,852
	Import	16,608	16,671	15,646	22,388
	Export	45,332	56,980	58,677	61,942
CB	Production	111,619	93,988	81,830	96,821
	Import	59,155	53,949	46,667	80,475
	Export	31,662	30,326	34,865	38,636
PA	Production	268,942	227,150	262,993	244,263
	Import	5,559	3,114	3	4
	Export	52,023	59,258	69,829	86,389
DOP	Production	244,380	188,854	224,300	122,459
	Import	210	52	48	96
	Export	160,843	108,075	173,896	84,555
PPG	Production	54,933	55,533	48,774	51,550
	Import	54,934	38,900	24,337	51,922
	Export	13,030	17,202	25,739	39,189
	Production	-	-	-	-
	Import	1,088,635	978,524	945,143	1,074,061
	Export	3,984	7,202	2,833	2,925
VAM	Production	451,498	453,774	405,627	472,089
	Import	8,761	8,401	18,469	21,810
	Export	187,331	199,072	172,967	191,386
PVA	Production	88,904	83,645	75,252	99,509
	Import	2,197	1,660	1,388	2,050
	Export	74,594	67,611	63,359	83,363
AB	Production	92,519	84,219	85,817	90,659
	Import	12,500	646	547	112
	Export	64,982	64,025	67,410	77,471

The Outlook

The Industry Development Bureau (IDB) of the Taiwanese government has worked out an official policy for the development of petrochemical industry. The policy stresses several points:

1. To assist medium to large-sized investments, so as to keep a moderate growth pace for the petrochemical industry. This is also needed to support downstream developments and to explore the international market. The selection of new product portfolios shall cope with the demand of free market.
2. To keep a reasonable competition environment for the domestic petrochemical market in an attempt to lift competitiveness.
3. To enhance the manufacturing technology through intensive R & D effort.
4. To produce high value-added items, diversifying into high-tech sectors.
5. To improve the environmental protection and industrial safety.
6. To conserve energy and to raise the efficiency of energy utilization.

The petrochemical industry is a global business. Producers from different regions and countries share a common environment of prosperity. The petrochemical market is on an accelerated way to recovery, according to some studies. Hopefully another peak of business cycle will come in the year of 2013-2014.