BASF-YPC Co. Ltd. is a 50–50 joint venture between BASF and SINOPEC with a total investment of $ 2.9 billion and was established at the end of 2000. Using state-of-the-art technology, the joint venture operates a steamcracker (600,000 metric tons ethylene per year) and nine downstream plants on its 220-hectare site in Nanjing on the Yangtze River.

Picture: BASF

China, the fastest growing economy in the world, is witnessing massive investments in new projects and plant upgrades in almost all segments of the chemical process industries, especially in the petrochemical sector as one of the basic industries. Especially, growth in ethylene and coal conversion technologies will play important roles in future. Equipment, technology and know-how for the process industries will be highlighted at AchemAsia.

China's *petrochemical* industry

China is now the 6th largest economy in the world, boasting a Gross Domestic Product (GDP) of $2.23 trillion in 2005. Measured on a purchasing power parity (PPP) basis, China would rank as the second-largest economy in the world, after the U.S. Likewise, China's rising status is impressive in the context of its $264-billion chemicals market. In 2005, China overtook Germany – with an output of $223 billion – to become the world's third-largest chemical producer, behind the U.S. and Japan, says the American Chemistry Council (ACC). And while growth of China's chemical industry is slowing gradually, it remains robust in comparison with the rest of the world. Early 2006 assessments put China at an average growth rate of over 16%, compared to less than 6% for the entire Asia/Pacific region and less than 4% worldwide. ACC forecasts that annual output growth of China's chemical industry will average 10.4% between 2006 and 2016, as the growth of the surrounding region and world markets stay on course.

For foreign process-industry investors, such rapid growth is even more enticing when China's current appetite for petrochemicals is factored in. China has been a major importer of petrochemical products for many years, importing $70 billion of chemicals in 2005, and having a $41-billion chemicals trade deficit, says ACC. And, in its 2006 China Report, SRI Consulting (SRIC) has forecast that China will remain a major importer in the next decade or so, despite rapid capacity increases to date. Even though petrochemicals is dominated by state-owned companies, foreign investment in the petroleum and chemical industries in China has been substantial, with more than 2,000 projects, SRIC says. Among the world's top 50 oil and petrochemical companies, 40 have set up joint or wholly owned ventures in China. Unlike the case in other manufacturing industries, most such foreign investors intend to supply the local market.

Recently, Chinese authorities have been trying to re-attract investors who were scared off by announcements that the nation will be more focused on protecting domestic enterprises, especially in evaluating foreign merger/acquisition

This article is based on an AchemAsia 2007 trend report. The complete article is available at www.achemasia.de.

attempts. The bottom line is that in future projects, China will be more selective in overseas participation. While China still welcomes all forms of foreign investment, it will open up its arms wider to investors who have advanced technologies to offer, China's official Xinhua news agency reported Chinese Vice Premier Wu Yi to have said recently.

In the meantime, new locations continue to emerge as regional chemical centers. One of them is the Shanghai Chemical Industry Park. As noted in a report by KPMG, leading foreign chemical companies such as DuPont, Dow Chemical, GE Plastics, Bayer and DSM have established chemical Research and Development (R&D) centers in Shanghai. In September of 2006, for instance, the Bayer MaterialScience subgroup inaugurated its new production facilities at the park. The project represents a total capital expenditure volume of about US$1.8 billion through 2009, the firm's biggest-ever project outside of Germany.

Joint ventures with domestic giants

Similarly, companies such as BASF and Shell are increasing their presence by expanding their production capacity in joint ventures with domestic giants. Meanwhile, some firms are moving entire business units to China. At the end of 2006, for instance, Celanese announced that it will relocate its acetyls business to Shanghai as early as spring 2007. Celanese derives about 20% of revenue and 30% of earnings from Asia and expects that to increase to 30% and 45-55%, respectively by 2010. China alone is expected to generate between $600 million and $700 million in revenue for the firm by 2010.

In addition to the widespread activity in China's east-coast industrial centers, opportunities will arise for multinational chemical companies over the next 15 years as the Chinese government seeks to open up its underdeveloped inland regions with large-scale infrastructure and industrial projects. China's eastern coastal regions are home to only 40% of the country's population, but account for 60% of GDP. The government's 11th five-year plan (2006-10) aims for better balance.

Major domestic players and growth areas

According to a ranking prepared by SRIC (see table on page 16), the fastest riser is China National Chemical Corp. (ChemChina), which is expanding rapidly through organic growth and acquisitions. ChemChina has gone from strength to strength since its creation in 2004 through a merger between two of China's biggest state-owned chemical enterprises, China National BlueStar Corp., and China National Haohua Chemical Corp. The company has also led the rest of the Chinese chemical industry in acquiring overseas assets. ChemChina bought feed additives company Adisseo (Antony, France) from private equity firm CVC Capital Partners, and olefins and polyethylene producer Qenos (Melbourne) from ExxonMobil Chemical and Orica, earlier this year.

According SRIC's ranking, Sinopec and PetroChina are by far the biggest chemical companies in China. Both companies are moving ahead with major programs to expand olefins and derivatives capacity, and have an-

The top 50 Chinese chemical companies ranked by 2005 sales

Rank 2005	2004	Company	Sales (in billions of Rmb)
1	1	Sinopec	823.77*
2	2	PetroChina	672.03*
3	3	Sinochem	189.98*
4	4	China National Offshore Oil Corp. (CNOOC)	87.45*
5	44	China National Chemical Corp. (ChemChina)	53.00*
6	5	Shanghai Huayi Group	28.22
7	6	Tianjin Bohai Chemical Industry	21.37
8	7	Shandong Haihua Group	15.57
9	19	Yuntianhua Group Co.	10.39
10	8	Shandong Binhua Group	10.30
11	9	GITI Tire Investment Co.	9.42
12	10	Xianglu Petrochemical Xiamen Co.	7.66
13	13	Hangzhou Zhongce Rubber Co.	7.29
14	11	Shandong Chengshan Group	6.83
15	35	Ningbo Daxie Liwan Petrochemicals Co.	6.73
16	17	Shandong Lubei Enterprises Group	6.45
17	46	Hubei Yihua Group	6.36
18	21	Triangle Group Co.	5.72
19	–	Transfar Group Co.	5.70
20	16	Jiangsu ChengXing Phosph-Chemicals	5.48
21	14	Doublestar Group Corp.	5.44
22	22	Juhua Group Corp.	5.35
23	32	Shandong Lihuayi Group	5.21
24	–	Weifang Hongrun Petrochemical	5.11
25	18	China Shenma Group	5.04
26	28	Shandong Linglong Rubber Co.	5.02
27	33	Dongming Petrochemical	5.01
28	50	Cheng Shin Rubber Xiamen Ltd.	4.82
29	12	Liaoning Huajin Chemical	4.73
30	57	Shandong Huaxing Petrochemical	4.63
31	24	Ningbo LG Yongxing Chemical	4.60
32	25	Tianjin Dagu Chemical	4.10
33	27	Zhejiang Longsheng Group Co.	4.05
34	34	Yantai Wanhua Synthetic Leather Group	4.00
35	29	BP Zhuhai Chemical	3.94
36	39	Shandong Zhenghe Group	3.89
37	79	Shandong Changyi Petrochemical	3.85
38	–	Shandong Jincheng Petrochemical	3.83
39	26	Shandong Liaocheng Luxi Chemical	3.74
40	23	Shanghai Baosteel Chemical	3.70
41	37	Fengshen Tire Co.	3.67
42	48	Shandong Kenli Petrochemical	3.54
43	31	Red Sun Group Corp.	3.48
44	45	Yabang Chemical Group	3.45
45	47	Kingfa Technology Inc.	3.37
46	65	Jiangsu Sopo Corp.	3.25
47	36	Lutianhua Group	3.24
48	60	Shandong Jingbo Petrochemical	3.22
49	89	Shandong Xishui Rubber Group	3.20
50	62	Shandong Shtar Science & Technology Group	3.18

** Includes non-chemical sales. Source: SRI Consulting (Beijing)*

nounced a combined $20-billion worth of investments by 2010.

The biggest growth area is in ethylene

The biggest growth area is in ethylene. Analysts expect the projects to more than double China's ethylene capacity, to about 15-million m.t./year. But China will still import about 15-million m.t./year of ethylene and derivatives, and 8-million m.t./year of propylene and derivatives, in 2014, SRIC says.

All the major Chinese producers of ethylene use steam cracking technology licensed from Western engineering companies. The ABB-Lummus process is the most widely used technology in China and is currently licensed in over half of the plants. Other technology licensors include Stone & Webster, Mitsubishi, Kellogg, and KTI.

Meanwhile, cooperation between China's ethyl-

ene producers and foreign technology licensors is gaining momentum. In September 2006, for example, on-specification, polymer-grade ethylene was produced by the first grassroots unit to utilize an ethylene recovery technology that was jointly developed by ABB Lummus Global and Sinopec's China Petroleum & Chemical Corp. The Sinopec Maoming Petrochemical Co. cracker is located in Maoming, Guangdong and has an ethylene capacity of 640,000 m.t./yr. The cracker also uses ABB Lummus Global/Sinopec cracking heater technology.

Sinopec recently held a ceremony to launch a long-delayed ethylene project at Tianjin. The RMB 26-billion project was originally to have been a joint venture with Dow Chemical, which dropped out of the project in 2002. Sabic has also held talks on joining Sinopec in the Tianjin project, which will include a 1-million m.t./year ethylene plant. Sabic, meanwhile, is negotiating an ethylene joint venture with polyvinyl-chloride (PVC) doors and windows manufacturer Shide Group (Dalian) at Dalian.

Sinopec recently secured government approval for a refining and petrochemicals joint venture with Kuwait Petroleum at Nansha that will include a 1-million m.t./year ethylene plant. Sinopec is also due to complete an ethylene plant at Quangang in 2009 in a joint venture with ExxonMobil and Saudi Aramco, as part of a refining and petrochemical joint venture. Sinopec is planning wholly owned steam crackers at: Caojing, near Shanghai; Ningbo; and Wuhan.

Sinopec's ethylene output increased 24.5% in the first half of 2006, to 3.03 million m.t., due to the start-up of new capacity including the BASF and BP (London) joint ventures. Sinopec and BASF recently announced a $500-million project to increase ethylene capacity and broaden the product slate of their joint venture at Nanjing. PetroChina began construction earlier this year of a wholly owned RMB 21-billion refining and petrochemical complex at Chengdu that will include an 800,000 m.t./year ethylene plant. Completion is due by 2010. A similar-sized refining and petrochemicals project at Fushun is under construction and a cracker is planned at Lanzhou. PetroChina is also building a 1-million m.t./yr ethylene and 500,000 m.t./yr propylene plant at Dushanzi, which will use technology from Linde.

Shell's joint venture is with China National Offshore Oil Corp. (CNOOC). It began production near Huizhou last spring. Other projects reaching completion this year include a $1-billion isocyanates joint venture involving BASF and Huntsman (Salt Lake City, Utah), as well as Chinese partners including Shanghai Hua Yi Group and Sinopec Shanghai Gao Qiao Petrochemical, at Caojing. An opening ceremony was held for that plant in mid 2006. Around the same time, Dow Chemical announced plans for a $200-million expansion of epoxy resins capacity at Zhangjiagang.

Chemicals from coal

High oil and gas prices have caused the Chinese government and chemical industry to step up efforts to produce more chemicals from one of China's cheapest and most abundant natural resources – coal. China is the biggest producer and consumer of coal. At least 13 new coal gasifiers have been built using the Shell Coal Gasification Process (SCGP), according to the head of gas technologies at Uhde, the firm that codeveloped the process with Shell. And according to the Gasification Technologies Council's online database, 18 major coal-gasification projects have started or will startup between 2005 and 2007.

The government is encouraging use of new technologies, such as coal liquefaction to make methanol and dimethyl ether (DME), for use as a clean fuel. Numerous small-scale methanol and DME projects have sprung up across coal-rich regions of China as a result. China produced 5.4-million m.t. of methanol in 2005, of which 3.5-million m.t. were derived from coal, according to a recent report by Xinhua news agency. Methanol plants with a combined capacity of almost 9-million m.t./year are under construction in China, and a further 10-million m.t./year of capacity is in the planning stages, Xinhua says. Fears of overcapacity and inefficiency caused the government to step in during mid 2006, announcing plans to regulate the coal-to-chemicals sector. The National Development and Reform Commission (NDRC; Beijing), China's top economic planning agency, announced that it would no longer approve coal liquefaction projects with capacity for less than 1-million m.t./year of methanol or DME, or 600,000-m.t./year of olefins. Coal liquefaction technology "is still in the experimental phase," and "the market has not been fully developed," NDRC says.

Since then, CNOOC and Choren Industries GmbH (Freiberg, Germany) launched a new joint venture – Choren-CNOOC Beijing Gasification Engineering Technology Co. Ltd. – to market technologies for gasifying solid feedstock such as coal and biomass.

Meanwhile, Sinopec announced plans in 2006 for a RMB 21-billion, coal-to-chemicals project at Erdos in China's autonomous region of Inner Mongolia. The project will have capacity for 4.3-million m.t./year of methanol, and 3-million m.t./year of DME. Meanwhile, Dow and coal company Shenhua Group (Beijing) are jointly studying an olefins project near Yulin based on methanol produced from coal. More traditional coal-based technology is behind the rapid development of China's acetylene-based PVC industry. ■