

## **ASIACHEM: China Coal Chemical Mid-Year Review 2010**

In 2009, China government announced the “petroleum & chemical industry stimulus”, which listed five modern coal chemical directions as demonstration projects for future development, namely CTL (coal-to-liquid), coal-to-DME (dimethyl ether), CTO (coal-to-olefins), SNG (coal-based synthetic gas) and CTMEG (coal-to-mono-ethylene glycol).

Though there were rush investments in the modern coal chemical industry before 2009, but few of them were brought in commercial operation except for many DME projects. 2010 becomes the “Demonstrative Year” of China modern coal chemical industry, with the successive completion of demonstration units to verify the feasibility and economic profitability.

As a dedicated consultancy on coal based energy & chemical, ASIACHEM is to make a review on the progression of CTL, CTO, SNG and CTMEG demonstration projects in 2010, also to forecast the developing trend.

### **— CTL**

The coal-to-liquids includes three different ways, direct CTL (DCTL), indirect CTL (ICTL) and coal-based methanol-to-gasoline (MTG). All the three major developing orientations of CTL processing, have their demonstration units built and under operation.

After one year of trial running, Shenhua Ordos DCTL project has now realized continuous and steady operation. As stated by an officer of Shenhua Group on the shareholder conference held in mid-June, daily output of the DCTL plant has been kept between 2000-2800t since May 2010. In addition, another 180kt/a ICTL plant sharing gasification unit with the DCTL unit was also started up with full success.

After three times of trial production starting from March last year, Inner Mongolia Yitai 160kt/a ICTL project using the process developed by Synfuels China has reached 5640h of continuous operation by the date of June 30<sup>th</sup> 2010 and the whole process line is now maintained under full load operation with daily output of 483t oil products, including 265t of light diesel, 51t of heavy diesel, 148t of naphtha, and 19t of LPG. The company obtained license of oil product wholesale from the Ministry of Commerce in February 2010.

Another CTL unit, Lu'an coal-based synfuel & polygeneration project restored production in mid-June 2010. The unit, consisting of two process lines based on cobalt and ferrous catalyst respectively, is expected to realize 210kt/a oil product capacity in total. Besides, the 18-30 ammonia/urea (180 kt/a ammonia & 300 kt/a urea) section amongst the polygeneration system was brought on stream in December 2009, whereas a F-T synthesis off-gas IGCC power generation plant is now under construction and scheduled to be complete in 2011.

ASIACHEM estimated that after the CTL demonstration units of different processes reaching their design capacity and collection of operational data, the cost of CTL production will be proven. The cost of large scale commercial CTL plants will be lower in the future than the current

demonstration units. The profitability of CTL process is more expectable if the refined oil pricing mechanism is unchanged in China and the oil price stay above USD70/bbl and.

#### — CTO

There three CTO projects currently under construction which is expected to complete and started up in Q3 this year in succession. All the three projects target polyolefin resins as final product and will be the first trial on the world to made plastic materials from coal resource.

Shenhua Baotou CTO project reached mechanical completion on May 31<sup>st</sup> 2010 and is scheduled to start chemical feed in September this year. Beforehand in may 28<sup>th</sup>, coal feed was led into the gasifier in this project with success. The project is the first industrial scale demonstration of DMTO process developed by Dalian Institute of Chemistry & Physics under Chinese Academy of Sciences (CAS).

Datang Duolun coal-based polypropylene (PP) project is designed to produce 460kt/a of PP in addition to the byproducts of 240kt/a of methanol, 129.5kt/a of gasoline and 66.6kt/a of LPG. Its PP unit of Dow Chemical's UNIPOL process was started up with success in November last year by sourcing propylene from outside. The whole project is scheduled to proceed commissioning in Q3 2010.

Another coal-to-520kt/a PP project, by Shenhua Ningxia Coal Group (Shenhua Ningmei), is based on ABB-Lummus Novolen gaseous phase polymerization process. The extruder-pelletizer in PP unit of the project was proven success by a trial running in May 2010. Blowing & purge of the plant are now almost completed and preparations for entire process flow are in progression.

ASIACHEM estimates that, since all the three projects shall be started up in 2010, China will establish 1.58Mt/a of coal-to-polyolefin capacity by the end of 2010, including 300kt/a of PE and 1.28Mt/a of PP. Such a scale will account about 7% of the total polyolefin capacity in China. CTO will become an important supplement to Chinese olefins supply and a major developing direction of coal chemical industry and methanol downstream derivatives. Also, the **2<sup>nd</sup> Coal-to-Olefins Conference** will be held in **Nov. 2010 in Beijing**, the policies & projects update will be focused.

#### — SNG

In SNG sector, there are three projects officially approved by the National Development & Reform Commission (NDRC), they are namely Datang Chifeng project, Datang Fuxin project and Huineng Inner Mongolia project. Designed capacities of the three projects totalize up to 10bnNm<sup>3</sup>/a of SNG. NDRC issued a "Notification on the Affairs to Normalize SNG Industry Development" on June 18<sup>th</sup> 2010, clarifying that all other SNG projects (including the proposed and ongoing projects) shall obtain approval from NDRC before the construction started.

Datang Chifeng project was approved by NDRC in August 2008 and the first production line of 1.3bnNm<sup>3</sup>/a capacity is scheduled to be completed by the end of 2010, when the SNG product shall be supplied to Beijing and surrounding areas through the pipeline included in the project. The whole project of three lines and 4bnNm<sup>3</sup>/a total capacity shall be completed in 2013.

Datang Fuxin SNG project was approved by NDRC and started construction in March 2010. The project is expected to be on-stream in 2013, to supply 4bnNm<sup>3</sup>/a of SNG to Shenyang, Fuxin, Tieling and other cities.

The third project, Huineng Inner Mongolia project of 2bnNm<sup>3</sup>/a SNG and 1bnNm<sup>3</sup>/a LNG (liquefied natural gas) capacity obtained NDRC approval in December 2009. Construction of the CNY13.55bn project was started on April 21<sup>st</sup> this year.

SNG industry will indirectly benefit from the China domestic gas price hike. Enacted since May 31<sup>st</sup> 2010, the price of home produced natural gas has increased by CNY0.23/Nm<sup>3</sup>, implying better profitability of SNG projects if they keep up the pace of pricing-up.

#### — **CTMEG**

Big gap between MEG supply and demand in Chinese market has made CTMEG a new hot spot of the developing coal chemical industry. CTMEG was listed in China's petroleum & chemical industry stimulus program published in May 2009.

Tongliao GEM (Gold Coal) Chemical CTMEG project, based on a process developed by FJIRSM-CAS, takes advanced position in China's CTMEG process demonstration. The project got through the whole process flow and outputted on-spec product in December 2009 and then, after modification of original design, the project now has capacity of 150kt/a of MEG and cogenerate 100kt/a of oxalic acid (OA). By a linked trial running, the project outputted on-spec OA product on May 3<sup>rd</sup> 2010. The plant is expected to reach design capacity by October 2010 after proper inspection, maintenance and rectification.

Besides the Tongliao GEM, CTMEG process R&D activities by other Chinese enterprises and institutes are expedited in progression. Shanghai Huayi 1500t/a CTMEG pilot unit is now under construction on the site of Shanghai Coking Factory, Wujing, Shanghai and is predicted to start trial operation in 2011.

Anhui Huaihua Group is cooperating with Shanghai Pujing Chemical Technology Co Ltd and using a novel process of "syngas catalytic synthesis to produce MEG" developed by East China University of Science & Technology, to build a 1000t/a syngas-to-MEG industrial experiment unit on its site in Anhui province. The unit shall enter testing stage in September this year and the preparation of scaled-up plant process design package is expected to be complete before the year end.

Construction of another coal-based syngas-to-MEG process pilot base project, developed by cooperation between China Wuhuan Engineering, Hubei Provincial Chemistry Research Institute and Henan Hebi Baoma Group, was started in January 2010. Design capacity of the pilot unit is 300t/a.

There are nearly 20 other CTMEG projects now at the stage of preliminary planning in China. Once the processes are proven on industrial demonstration units, China will soon form over

1Mt/a of CTMEG capacity.

In general, 2010 will become the critical year of Chinese modern coal chemical demonstration. CTL projects will achieve experiences and data from continuous operation, sufficient to lay a foundation for future large size commercial plants. CTO projects will be completed in succession and start whole process flow commissioning within the year. SNG projects will start construction in sequence and be benefited from the completion of West-to-East Gas pipeline network and domestic gas pricing reform. And the last but not the least, CTMEG process R&D and pilot activities are progressing in parallel, also demonstration at industrial scale is expected to achieve success in this year.

Oil price will stay at high level today and in future, which is determined by the limited oil/gas resources, additional risk and cost of off-shore oil production, and increasing demand on energy and chemicals by human society. In China, coal remains to occupy the dominant position in energy consumption structure. Facing to the mandatory obligation of reducing 40-45% carbon emission per unit GDP by 2020 against the level of 2005, to develop a coal gasification based energy & chemical industry system is a viable way, which will help to realize clean and efficient use of coal resource and supplement or partial substitute of oil and chemical raw materials. Chinese modern coal chemical industry will, through the successful operation of demonstration units, prove the techno-economic feasibility and achieve steady development to become an important role in the nation's energy & chemical industry sector.

#### The main Modern Coal Chemical Demonstration Project in China

Location	Company	Product	Designed Capacity (kt/a)	Status
Ordos, Inner Mongolia	Shenhua	Oil Products	1080	Operating
Jincheng, Shanxi	Jinmei	Gasoline	100	Operating
Changzhi, Shanxi	Lu'an	Oil Products	160	Startup
Ordos, Inner Mongolia	Yitai	Oil Products	160	Operating
Ordos, Inner Mongolia	Shenhua	Oil Products	180	Startup
Ordos, Inner Mongolia	Huineng	SNG	2 billion Nm <sup>3</sup> /a	Under Construction
Chifeng, Inner Mongolia	Datang, Beijing Gas, New Horizon Capital	SNG	4 billion Nm <sup>3</sup> /a	Under Construction
Baotou, Inner Mongolia	Shenhua	PE/PP	PE 300 kt/a PP 300 kt/a	Startup Preparing
Duolun, Inner Mongolia	Datang	PP	460	Startup Preparing
Yinchuan, Ningxia	Shenhua Ningmei	PP	520	Startup Preparing
Puyang, Henan	Sinopec	Ethylene/Propylene	200	Under Construction
Tongliao, Inner Mongolia	GEM Chemical	MEG	200	Startup
Ordos, Inner Mongolia	Zhongtian Hechuang	DME	3000	Portfolio to be reconsidered

Source: ASIACHEM