CHEMICAL ECONOMICS - METHANOL

World methanol demand is now approaching 80 million tonnes per year. Its main use is as an intermediate used in the production of formaldehyde (for urea-formaldehyde resins used extensively in the wood industry), acetic acid (for poly acetate polymers) and methyl tertiary butyl ether (MTBE, a petrol additive). It is also used as a freezing point depressant in oil pipelines, a solvent and in China, it is used directly as a petrol additive and extender. Developments in China over the last decade has seen the rise in methanol use for dimethylether (DME, a blending component and extender for LPG) and the production of olefins (MTO/MTP) which enables the production of petrochemicals from coal as opposed to imported oil or naphtha. The approximate breakdown of methanol use is given in Figure 1.

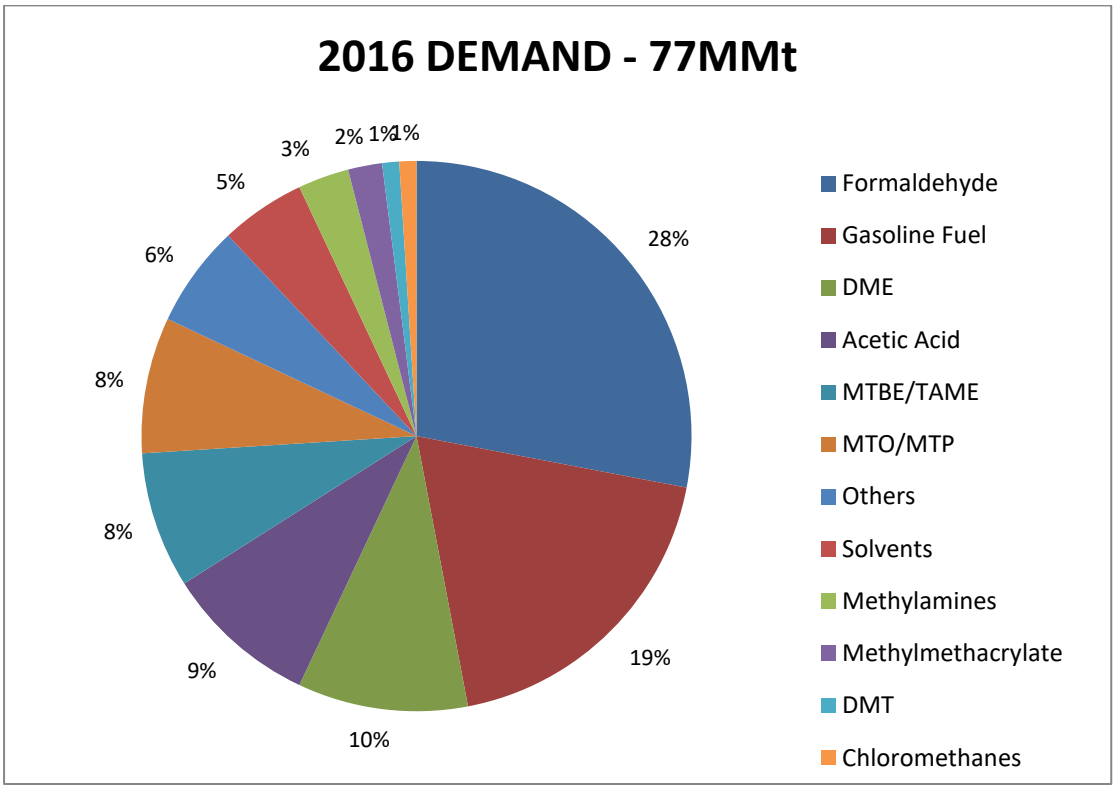

Figure 1: World usage of methanol

Methanol is made from synthesis gas, a mixture of carbon monoxide, carbon dioxide and hydrogen which is made from any low cost carbon source such as coal or natural gas. The pertinent reactions are:

$$CO + 2H_2 = CH_3OH$$

$$CO_2 + 3H_2 = CH_3OH + H_2O$$

The main commercial catalyst (copper on zinc oxide supported on alumina) is active for the water-gas-shift reaction:

$$CO + H_2O = CO_2 + H_2$$

This allows a wide range of composition of the synthesis gas useful for methanol synthesis. In fact, the most commonly used catalyst ($Cu/ZnO/Al_2O_3$) appears to work by the second reaction above via carbon dioxide so some carbon dioxide is beneficial to the reaction rate (too much oxidises the catalyst and inhibits the reaction).

Methanol production and supply outside of China is dominated by relatively few players whose facilities ship methanol, typically in parcels of 10k to 40k tonnes to the major users in the US, Europe, North Asia and the east coast of China.

Methanol production is an alternative method to monetize large gas reserves rather than LNG or long distance pipelines, for example in Canada, Russia, the Middle East and Iran. Gas demand for a world scale facility is much lower than the optimum scale for LNG which attracts countries with large but not super large gas reserves. Prominent producing countries in this sector are Chile, New Zealand and Trinidad and Tobago. These countries were prominent suppliers in the past decades but depletion of the initial reserves has curtailed production in recent times.

The shale gas revolution in the US has prompted several new facilities to be constructed especially in the chemical centres of Texas and Louisiana. The fall in gas prices in North America is spurring renewed interest in Canada. In our region there are large operations in Malaysia, Indonesia and Brunei.

The world's largest producer is China where coal is the main feedstock. Facilities range from small older plants to modern large scale facilities. China is unusual in that large amounts of methanol are used in petrol blending. Outside China, although there have been a large number of demonstration programs, methanol blending in fuel is prohibited in most jurisdictions and is opposed by the vehicle manufacturing industry.

In Australia, large corporations have concentrated on LNG developments to monetize their gas resources and have ignored the methanol option. Proposals to develop methanol projects have generally come from smaller players. Of note is that back in the 1980s, BHP's petroleum division demonstrated technology that could be placed on a ship for off-shore methanol production. The aim was to use gas associated with off-shore oil developments using FPSO (floating production, storage and off-take) technology and where the associated gas would have no alternative use and have to be flared. They built a demonstration plan at Laverton in Melbourne (now owned by Coogee Energy) which remains Australia's only methanol facility servicing local industry. However, recent volatility in the price of east coast natural gas has made the facility uneconomic against imports and at the time of writing is moth-balled.

There is a large spot market for methanol which guides the prices for methanol sold on contract. Like all commodity chemicals the price fluctuates over time. For methanol, there are often long periods of relative low but stable price which is disrupted by a rapid rise (less than 6 months) to often double or more the previous base. This is often followed by a similar rapid fall to somewhere near the base. In many cases this price volatility seems to a function of the supply/demand balance of the methanol market rather than changes in the general business cycle. Recent price history is shown in Figure 2.

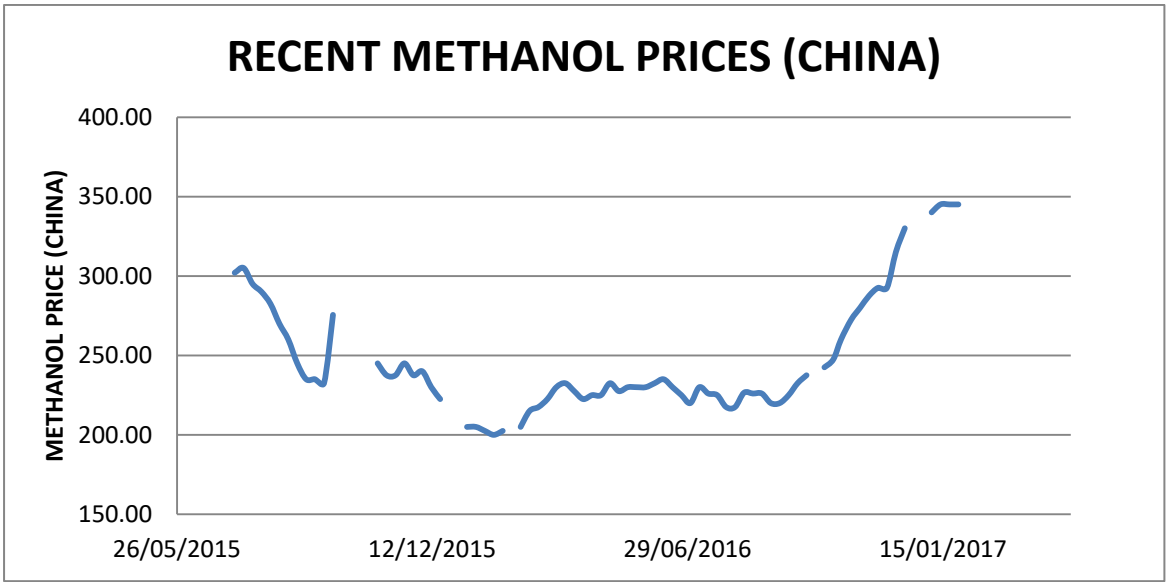

Figure 2: Recent price cycle for methanol (CFR China east coast); illustrating rapid fall, plateau period and rapid rise.

At the time of writing the methanol market appears in a period of rising price, with the price doubling over the past 6 months. The present cycle could have been started when some large export plants in the Middle East entered a scheduled shut-down for maintenance and the production shortfall was exacerbated by lower supply from the large Trinidad operations due to restrictions in the gas supply. Furthermore, the rally in thermal coal prices over the past year has resulted in cost increase in Chinese production. It will be interesting to see how long the present high prices persist and if this assists the re-opening of the Laverton methanol plant.

The world growth in methanol demand is sufficient to support the introduction of one new large methanol plant per year into the world market. However, chemical facilities never come on-stream in an orderly manner and the supply/demand balance is influenced by "lumpiness" in the number of facilities coming on-stream over time. This further exacerbates the volatility in the market price.

From the perspective of production economics, a new facility should aim to produce methanol at a price below the minimum in the cycle. This ensures profitability over the cycle and generates the opportunity for windfall profits when prices rise. The general production economics are illustrated in Figure 3.

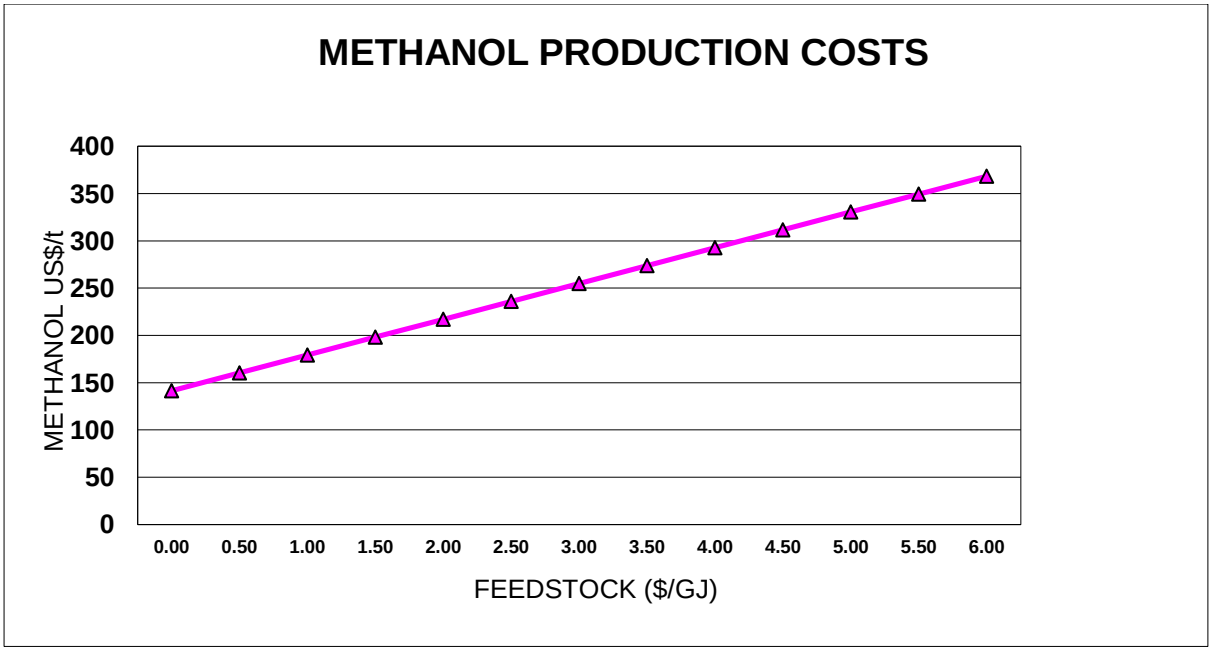

Figure 3: Estimated production cost of methanol from gas for US Gulf facilities.

As is illustrated in the Figure, with methanol prices in the region of US$250/t and allowing US$50/t shipping cost, the FOB (free-on-board) production cost has to be in the vicinity of US$200/t. This means that a gas based plant, gas costs have to be US$2/GJ or less for an export driven operation. In the case of the US where transport costs are minimised by being juxtapose to the user, gas prices of US$3/GJ can be viable (this is typical for prices for US gas in recent months).

These levels of gas prices are well above Australian east cost gas prices but could be achieved from the very large gas developments off western and northern Australia. It is moot to consider if any of the current players would consider methanol as an alternative way to monetize gas other than LNG.

DK -Associates (Singapore) is thanked for information on methanol prices.

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