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Methanol applications

Date:	6 April 2018	Priority:	Medium
Security classification:	In Confidence	Tracking number:	2810 17-18

Information for Minister
Hon Dr Megan Woods Minister of Energy & Resources

Contact for telephone discussion (if required)			
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s 9(2)(a)	Principal Policy Advisor, Resource Markets Policy	s 9(2)(a)	

The following departments/agencies have been consulted
N/A

- Minister's office to complete:**
- | | |
|---|--|
| <input type="checkbox"/> Approved | <input type="checkbox"/> Declined |
| <input type="checkbox"/> Noted | <input type="checkbox"/> Needs change |
| <input type="checkbox"/> Seen | <input type="checkbox"/> Overtaken by Events |
| <input type="checkbox"/> See Minister's Notes | <input type="checkbox"/> Withdrawn |

Comments

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Purpose

To respond to a request from your office on the applications of methanol, particularly with regard to energy uses.

s 9(2)(a)

Dr Marcos Pelenur
Manager, Resource Markets Policy
Building, Resources and Markets, MBIE

5/4/18

What is methanol?

1. Methanol is an intermediate petrochemical feedstock used to produce hundreds of everyday industrial and consumer items. Methanol is comprised of four parts hydrogen, one part oxygen and one part carbon.
2. Methanol is most commonly produced on an industrial scale using natural gas as the principal feedstock. Methanol is usually made by reforming natural gas with steam and then putting the resulting synthesized gas mixture through conversion and distillation processes to create pure methanol. One-third of the world's methanol is produced from coal, primarily in China.
3. Methanol is a clear, colourless liquid that is water soluble and has no discernable odour in low concentrations. Like most chemicals and fuels, methanol is flammable and toxic and must be handled and used with care.

What is methanol used for?

Chemical uses

Formaldehyde (29% of global demand)

4. The main application for methanol is formaldehyde. Formaldehyde is used in a vast range of end-products including:
 - a. **Consumer products:** Photographic film, paper towels, cosmetics, carpeting, furniture, cabinets, solvents, and paint;

- b. **Automotive industry:** Under the bonnet components, antifreeze, fuel system components, brake pads;
- c. **Health care applications:** Vaccine manufacturing, hard gel capsule manufacturing, pharmaceutical research;
- d. **Construction industry:** Carpet underlay, structural wood panels.

Acetic acid (9% of global demand)

- 5. Acetic acid is used to produce terephthalic acid (PTA). PTA is used to make polyester fibre for carpeting and textiles. PTA is also a basic component of polyethylene terephthalate (PET) plastic, which is used to package beverages and household products. In addition to its clarity and impact resistance, PET plastic is 100 per cent recyclable.
- 6. Fleece jackets and spandex outfits are made from acetic acid.
- 7. Acetic acid is a major component of vinyl acetate monomer, which is used to manufacture water-based paints and adhesives and is a replacement for solvent-based products.

Methyl methacrylate (MMA) (2% of global demand)

- 8. MMA is used in such things as safety glazing, panels, illuminated light displays, food and pharmaceutical packaging. A major application of MMA polymers and copolymers is in surface coatings and impregnation resins to give colour fastness and weather-resistance properties to latex paints, lacquer resins and stoving enamels. For example, exterior latex paint is based on emulsions containing MMA while other uses include industrial finishes, and metal and foil coatings.
- 9. Over 80% of MMA consumption is accounted for in the construction and automotive industries. A growth sector has been electronic applications where it is used in flat screen televisions and liquid crystal displays.

Methanol to olefins (10% of global demand)

- 10. Olefins includes ethylene, propylene and butadiene. Ethylene and propylene are important sources of industrial chemicals and plastics. Butadiene is used in the manufacture of synthetic rubbers and elastomers.
- 11. Olefins can be produced from coal, natural gas, or methanol. Growth in methanol to olefin production has been a major source of methanol demand growth over the past decade.

Methylamines

- 12. Methylamines are used in a wide range of agricultural chemicals, including herbicides, fungicides, insecticides, biocides and miticides.

Chloro-methane

- 13. Chloro-methanes are widely used as a refrigerant.

Energy uses

Methyl tertiary-butyl ether (MTBE) (10% of global demand)

- 14. MTBE is blended with petrol to enhance octane. It is common in refineries across Europe and Asia, with approximately 70% of the petrol sold in Asia containing MTBE. MTBE is not sold in North America, Australia or New Zealand.

Direct blending into petrol (10% of global demand)

15. Like ethanol, methanol is an alcohol that can be blended directly with petrol. Methanol is a clean-burning, high-octane fuel component, as the oxygen present in methanol aids in more complete fuel combustion. However, methanol is also considered highly corrosive and its use is not supported by vehicle manufacturers.
16. Direct blending of methanol into petrol is most common in China, where methanol consumption in fuel products has risen sharply and is estimated to have been more than 500,000 barrels per day in 2016 according to the U.S. Energy Information Administration (EIA).
17. Outside of China, direct methanol blended into petrol is sold in small volumes in the Netherlands and the United Kingdom.
18. As part of the 2017 amendments to the Engine (Fuel Specifications) Regulations 2011, New Zealand allowed a maximum limit of 3 per cent of methanol to be blended with petrol (up from a previous limit of 1 per cent). This is consistent with the limits provided for in the European fuel standard.

Dimethyl ether (DME) (10% of global demand)

19. DME is most commonly used as a replacement for propane in liquefied petroleum gas (LPG), but can also be used as a replacement for diesel fuel in transportation. Its main use is for household cooking and heating in China.

Biodiesel (4% of global demand)

20. Methanol is a key component of renewable biodiesel. Depending on the oils used to produce biodiesel, there is between 8 per cent to 13.5 per cent methanol.

Marine fuel

21. Methanol can be used as a marine fuel in tankers that have been specially designed for this purpose. Methanol significantly reduces emissions of sulphur oxides (SO_x), nitrogen oxides (NO_x) and particulate matter, compared to conventional bunker fuel or marine diesel.
22. Methanex operates seven ships that can operate on methanol, fuel oil, diesel or gasoil. One of these vessels, the Taranaki Sun, is frequently used to load and transport methanol from New Zealand.

Other energy applications

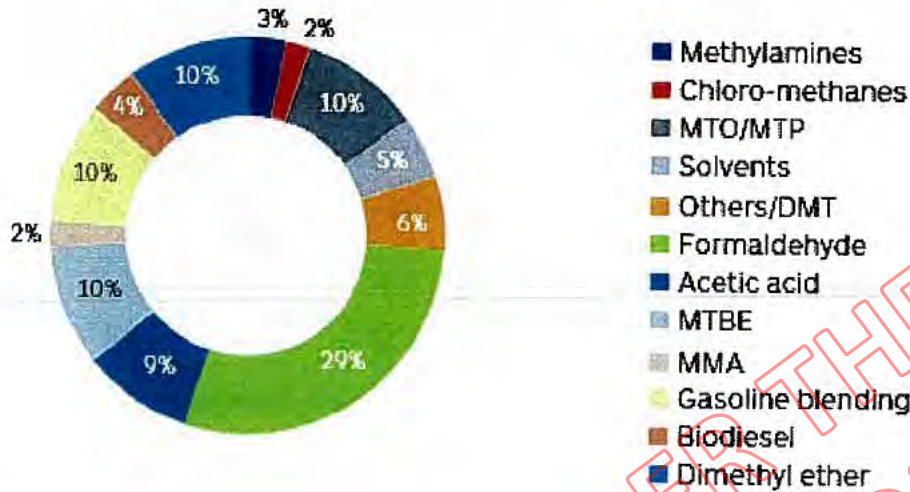
23. Methanol is also used in smaller volumes to produce fuel cells, for power generation (notably for peaking purposes), and for industrial boilers (notably in China).

Methanol demand

24. There are over 90 methanol plants worldwide with a combined production capacity of about 110 million metric tons (almost 36.6 billion gallons or 138 billion liters). According to the consulting firm IHS, global methanol demand reached 70 million metric tons in 2015, driven in large part by emerging energy applications for methanol which now account for over 40% of methanol consumption. Demand growth for methanol is being driven by its energy use applications.
25. In 2017, 57% of global demand for methanol came from China, with other parts of the Asia-Pacific accounting for 16%, Europe 15%, North America 9% and Latin America 3%.

26. The primary buyers of methanol are large chemical companies who process methanol for other applications. These buyers include Celanese, BP, Momentive, Sanjiang, Sailboat, Sabc, and BASF.

2015 World methanol demand by application



Source: IHS Chemical

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World methanol demand by region



Source: IHS Chemical

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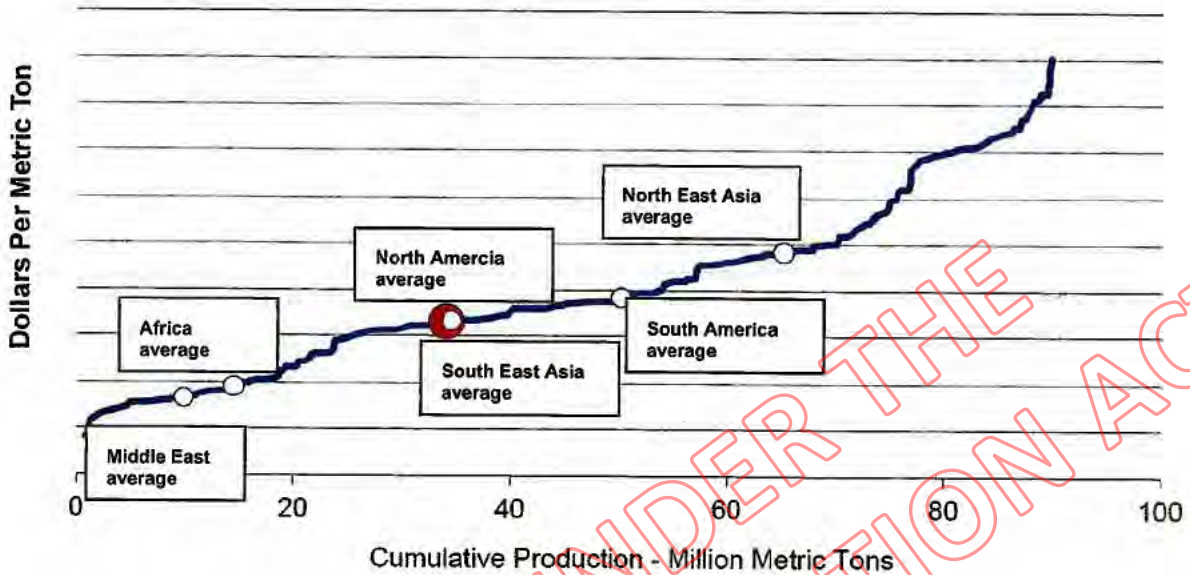
Global cost curve for methanol production

27. Most of China's methanol supply is from domestic production. About two-thirds of China's methanol feedstock is produced from coal and the remainder from coking gas (a by-product of steel production) and natural gas.
28. Chinese methanol produced from coal is the marginal tonne of global methanol and as such sets the price.

29. Methanol produced from coal emits between three to four times as much greenhouse gas emissions as that produced from methanol produced from natural gas.

World cost curve for methanol (Source: IHS)

(Price Basis = IHS, Cost Basis = Plant Gate,
Operating Rate Basis = IHS Baseline)



Where does New Zealand fit in?

30. With total operating capacity in New Zealand of 2.4 million tonnes, Methanex's methanol production facilities in New Zealand are the largest in its portfolio and significant even at a global scale. Methanex's New Zealand operations serve the Asia-Pacific market. When gas supply is constrained, as it was after the Maui reserve redetermination of 2002/03, Methanex is the first to be affected and forced to scale back its operations. The direct consequence of Methanex scaling back its operations in New Zealand is that this global supply is met by higher cost, and significantly higher emitting, methanol produced from coal in China. As noted, the greenhouse gas emissions from methanol produced from coal are three to four times that of methanol produced from gas.