Overview of the Asian fuel ethers markets and opportunities for Europe

World Biofuels Markets Congress
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Working closely with fuel policymakers, regulators and stakeholders in the fuel industry, ACFA supports and promotes the use of cleaner automotive fuels based on principles of sound science, cost efficiency and sustainability of the environment.
A bit of history

Where is Asia now:
- in gasoline quality
- in fuels ethers usage
- in bio-ethers development
- Japan: bio-ETBE biofuel of choice

Opportunities for Europe
A bit of history

• Early 90’s: development of clean gasoline and fuel ethers in Asia.
  – Two poles: Middle East and Asia/Pacific.

Middle East:
  – promoted by local MTBE producers;

Asia/Pacific:
  – driven by real necessity of better clean air
    (Bangkok and Jakarta being the cities among the ones with the worst air quality in the world).
A bit of history

• MTBE begun to be largely produced and consumed in Saudi Arabia, South Korea and China and commonly imported in Taiwan, Thailand, Indonesia.

• In 1992 the MTBE consumption in Asia (1.6M ton) was only 16.5% of total world demand(*).

• In 2011 the expected demand of MTBE+ETBE in Asia is at 11.9M ton, 56.4% (**)) of world demand.

(*) Source: DeWitt & Co., Inc.
(**) Source: JJ&A
A bit of history

FUEL ETHERS DEMAND IN ASIA 1992-2011

Where is Asia now in gasoline quality

- Despite the undoubted progress made, gasoline quality in many Asian countries is still far away from being satisfying.

- Still 13 over 15 of the world’s most polluted cities are in Asia.

- Therefore, the way to clean fuels in Asia is still long.
Where is Asia now in gasoline quality

Main reasons:

- lower level of complexity of Asian refining system compared to Europe and United States.

- somewhere the clean fuels process has yet to start: Iraq, Myanmar, Palestine, Yemen still have leaded gasoline.

- only five Asian countries have reached 50 ppm sulphur content or less: Hong Kong, Japan, Singapore (diesel only), South Korea, Taiwan.

- barrier to free trade (including fuel ethers trade) caused by adulteration and governmental subsidized prices.
Where is Asia now in gasoline quality

- Summarizing:
  - Asia has a variegate reality;
  - there is still lead around, although in marginal countries;
  - sulphur content is a big issue;
  - the other quality key parameters (olefins, benzene, aromatics contents) are quite good in North Asia but somewhat poor in Southeast Asia;
  - the biggest Asian countries, China and India, are going to have Euro III standard next year.
Global Gasoline Sulphur Limits

Source: HART's International Fuel Quality Center, May 2010

CLEAN AIR THROUGH CLEAN FUELS
## Current Select Gasoline Standards (North Asia)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>RON</td>
<td>89/96</td>
<td>92/95/98</td>
<td>95</td>
<td>91/94</td>
<td>90/93/97</td>
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<tr>
<td>Aromatics vol%, max</td>
<td>-</td>
<td>36</td>
<td>35</td>
<td>24**</td>
<td>40****</td>
</tr>
<tr>
<td>Olefins vol%, max</td>
<td>-</td>
<td>18</td>
<td>18</td>
<td>18</td>
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<tr>
<td>Benzene vol%, max</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.7</td>
<td>1.0</td>
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<tr>
<td>Oxygen wt%, max</td>
<td>1.3</td>
<td>2.7</td>
<td>2.7</td>
<td>2.3</td>
<td>2.7</td>
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<tr>
<td>Sulphur ppm, max</td>
<td>10</td>
<td>50</td>
<td>50</td>
<td>10</td>
<td>150</td>
</tr>
<tr>
<td>RVP kPa</td>
<td>65/93*</td>
<td>60</td>
<td>60</td>
<td>60/96***</td>
<td>72/88*</td>
</tr>
</tbody>
</table>

* Summer/winter
** Either aromatics 24 vol% max and olefins 16 vol%, or aromatics 21 vol% max and olefins 19 vol% max.
*** Jun-Aug 60kPa; Oct-Mar 96kPa
**** If total aromatics and olefins content is controlled, the maximum allowable aromatics limit is 41 vol%.
## Current Select Gasoline Standards
### (Southeast Asia)

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RON</td>
<td>90/92/95</td>
<td>88</td>
<td>91</td>
<td>95</td>
<td>91/95</td>
<td>81/93/95</td>
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<tr>
<td>Aromatics vol%, max</td>
<td>40</td>
<td>no limit</td>
<td>50</td>
<td>40</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Olefins vol%, max</td>
<td>38</td>
<td>no limit</td>
<td>no limit</td>
<td>no limit</td>
<td>no limit</td>
<td>no limit</td>
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<tr>
<td>Benzene vol%, max</td>
<td>2.5</td>
<td>no limit</td>
<td>5.0</td>
<td>5.0</td>
<td>3.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Oxygen wt%, max</td>
<td>2.7</td>
<td>2.7</td>
<td>2.7</td>
<td>2.7</td>
<td>11*</td>
<td>2.0</td>
</tr>
<tr>
<td>Sulphur ppm, max</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Lead g/l, max</td>
<td>0.005</td>
<td>0.3</td>
<td>0.013</td>
<td>0.013</td>
<td>0.013</td>
<td>0.005</td>
</tr>
<tr>
<td>RVP kPa</td>
<td>43-75</td>
<td>69 (max)</td>
<td>45-60</td>
<td>45-60</td>
<td>62</td>
<td>85/62</td>
</tr>
</tbody>
</table>

* Oxygenates content vol% maximum 11
Fuel Specifications by 2012 (Asia Pacific)

**EURO V equivalent**
Australia, Hong Kong, Japan, New Zealand, South Korea, Taiwan

**EURO IV equivalent**
Singapore, Thailand

**EURO III equivalent**
China, India

**EURO II equivalent**
Brunei, Fiji, Indonesia, Laos, Malaysia, Philippines, Sri Lanka, Vietnam

**PRE-EURO or EURO I equivalent**
Bangladesh, Burma, Cambodia, Nepal, Pakistan

Source: IFQC, June 2010
Where is Asia now in fuel ethers

- China is the world’s largest MTBE producer with approx 6.8M ton/yr of installed capacity at the end of 2010(*);
- China became MTBE net importer in 2009, importing approx. 400 Kton(*). During 2010 such figure has increased, up to 740 Kton(*);
- Despite the announcement of new units being in construction or projected, China is likely to remain a net importer for the medium-long term.

Source: C1 Energy
Where is Asia now in fuel ethers

- Singapore, South Korea and Taiwan are big producers and importers. Overall, their 2009 installed capacity is 1.75M ton/yr (*) and their imports in 2009 was in excess of 800 Kton(*).

- Malaysia owns the biggest MTBE merchant unit in Asia/Pacific, with an installed capacity close to 350 Kton/yr(*). The country in the last few years became a medium-size MTBE importer.

(*) Source: JJ&A
Where is Asia now in fuel ethers

- Saudi Arabia is the world’s second largest producer;
- Middle East is the world’s second largest MTBE production area with approx. 30% of production capacity(*);
- Contrary to Asia/Pacific, Middle East is a large exporter of MTBE. It covers the excess of demand of Asia/Pacific and Europe. On the long term the supply/demand balance of the area will be more driven by the local consumption.

(*) Source: JJ&A
Where is Asia now in fuel ethers

ASIAN MTBE PRODUCTION CAPACITY

<table>
<thead>
<tr>
<th>Country</th>
<th>Capacity (KT/YR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>6760</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>4020</td>
</tr>
<tr>
<td>S. Korea</td>
<td>707</td>
</tr>
<tr>
<td>Taiwan</td>
<td>680</td>
</tr>
<tr>
<td>Iran</td>
<td>620</td>
</tr>
<tr>
<td>Qatar</td>
<td>600</td>
</tr>
<tr>
<td>Others</td>
<td>1394</td>
</tr>
</tbody>
</table>

SOURCE: JJ&A 2010 and C1Energy
Where is Asia now in fuel ethers

2009 MTBE IMPORT: MAIN ASIAN COUNTRIES

- Singapore: 409 KT/yr
- China: 404 KT/yr
- Taiwan: 280 KT/yr
- S. Korea: 176 KT/yr

SOURCE: JJ&A 2010 and C1 Energy
Where is Asia now in fuel ethers

• Summarizing:
  – Present fuel ethers demand is mainly concentrated in North Asia;
  – However, gasoline quality is worse in South-Asia an Middle East;
  – Therefore, there is still a big potential for fuel ethers in the entire Asia, in the North mainly driven by gasoline demand expansion and in the South and Middle East mainly by quality improvements.
Where is Asia now in bio-ethers

- The bio-ethers era in Asia began in Japan during 2007;
- The test program aimed to introduce a generalized blending of bio-ETBE as from 1st January 2010.
Japan: bio-ETBE biofuel of choice

- Main drivers towards biofuels:
  - Lack of petroleum resources
  - Need to cut emission of GHG (Kyoto Protocol)

- Bio-ETBE undergone rigorous evaluation before being selected as the biofuel of choice for gasoline in Japan;

- Most Japanese refiners prefer bio-ETBE because it requires less investment and modification on the USTs and control of the fuel quality is also easier;
Japan: bio-ETBE biofuel of choice

- Auto manufacturers prefer bio-ethers (over alcohols) on the basis of emissions benefits, vehicle performance and existing regulations;

- By blending 7% bio-ETBE into gasoline, a greater utilization of bio-ethanol in the production of gasoline is possible without compromising the gasoline quality.
Japan: bio-ETBE biofuel of choice

- The program was supported by an investment plan to modify for ETBE production the four existing, although idled, Japanese MTBE plants: Idemitsu Chiba, Nippon Oil Negisi, Cosmo Oil Sakai and JOMO Kashima.

- Nippon Oil unit started up in December 2010 and Cosmo Oil unit announced its start-up during 2011.

- To cover the remaining demand Japan is massively importing ETBE. Japanese ETBE demand has been estimated 700 kton during 2010 and is expected to rise gradually in the following years.
Japan: bio-ETBE biofuel of choice

Source: JJ&A 2010
Where is Asia now in bio-ethers

• So far, the Japanese way for biofuels has not been followed by any other Asian country yet. Only KPetro in South Korea is testing bio-ETBE, but it is not a national trial.

• However, PetroVietnam has shown interest in the project of a bio-ETBE unit for an approximated capacity of 150 Kton/yr in its refinery at Dung Quat.
Opportunities for Europe

• Investments in Asian new plants;

• Technology export by the European engineering companies specialized in technology for the production of fuel ethers and bio-ethers;

• Bio-fuel export in countries which are massive importers of bio-ETBE such as Japan;

• Export of legislation principles: main Asian countries for their legislation on pollutant emissions and for fuel quality have adopted the European pattern (Auto Oil programs and Euro I, II, III etc., standards).
THANK YOU!