World Fuel Ethanol
Analysis and Outlook

Prepared for METI

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World Fuel Ethanol
Some basic concepts

• By production route:
  Fermentation vs. Synthetic

• By composition:
  Anhydrous vs. Hydrous

• By end-use:
  Beverage, Industrial, Fuel
World Fuel Ethanol

The production route

• Synthetic ethanol: Ethylene, coal; non-renewable

• Fermentation ethanol: Grains, sugar crops, tapioca, wood etc; renewable
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The largest synthetic producers

- Sasol
- SADAF
- BP
- Jilin Chemicals
- Japan Ethanol
- Mossgas
- Sodes
- Equistar
- Aprechim
- Chempetrol
- Neftochim
- Neftochim

Capacity (1000 tonnes/y)
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Share of synthetic ethanol

Fermentation 95%
Synthetic 5%
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Composition

• Anhydrous:
  99% pure, may be used in fuel blends.

• Hydrous:
  96% pure, may be used as 100% fuel substitute.
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Fuel alcohol in Brazil

Hydrous
Anhydrous

mln litres


0 2000 4000 6000 8000 10000 12000 14000 16000

Hydrous
Anhydrous
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End use

• **Beverage alcohol:**
  Alcoholic spirits: vodka, shochu etc.

• **Industrial alcohol:**
  Cosmetics, paints, inks.

• **Fuel alcohol:**
  Blends or pure form.
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Ethanol production by type


0 10000 20000 30000 40000 50000 60000 70000 80000

Industrial  Beverage  Fuel

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The drivers of growth I

• Ethanol is good for the environment (Kyoto)
• good for rural areas
• reduces dependence on oil imports
• enhances technological knowledge base
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The drivers of growth II

• Demand is virtually unlimited.
• Cost reduction potential is huge.
• A tried and tested technology.
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Success factors for biofuels

- Feedstocks
- Technology
- Policy
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World fuel ethanol production by feedstock

- Sugar crops 61%
- Grains 39%
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Ethanol yields per ha

USA (corn) –
Brazil (cane) –
France (beet) –

Production (litres/ha)
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Ethanol yields per tonne of feedstock

- USA (corn)
- Brazil (cane)
- France (beet)

Production (litres/tonne)
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Gross feedstock costs per litre of fuel ethanol

- USA (corn)
- Brazil (cane)
- France (beet)

Costs (US Cents/litre)
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Energy balance by feedstock

- Sugar cane
- Biomass
- Sugar beet
- US corn
- Wheat
- RME (Biodiesel)

Energy output/Energy input
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The case for political support

• Ethanol may serve socially desirable goals but it...
  • is more expensive than gasoline
  • faces an unfavourable opportunity cost structure
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Production cost reducing subsidies

• Feedstock price support.
• Capital cost support.
• Income tax concessions.
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Income enhancing subsidies

• Excise tax concessions.
• Guaranteed (captive) markets.
• Price guarantees.
• Direct price support
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Ethanol in Brazil

Ethanol in per cent

Ethanol
Gasoline
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Brazil – ethanol vs. gasoline economics

Price advantage of alcohol over gasoline
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Brazil’s ethanol/methanol trade

Imports
Exports
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Determinants of volatility in Brazil

- The weather: El Nino, La Nina.
- Sugar cane serves as raw material in two (four) markets:
  - Sugar (domestic and international)
  - Ethanol (domestic and international)
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Brazil – ethanol vs. sugar economics

![Graph showing the comparison between Sugar domestic and Anhydrous alcohol prices from 1999 to 2003. The graph indicates a trend where Anhydrous alcohol prices generally exceed Sugar domestic prices, with significant fluctuations over the years.](image-url)
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Brazil – ethanol vs. sugar economics

Profitability domestic sugar/ethanol
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Brazil – ethanol vs. sugar economics

- Sugar exports (VHP)
- Anhydrous alcohol (AAC)
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Brazil – ethanol vs. sugar economics

Profitability sugar exports/ethanol
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Remedies

- Spread cane growing over the country.
- Decouple ethanol from sugar production (dedicated ethanol-for-export plants).
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Will high stocks boost US ethanol exports?
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The European Union

![Graph showing fuel ethanol production in Sweden, Spain, and France from 1991 to 2003.](chart.png)
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The European Union

![EU total](chart.png)
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EU to become net ethanol importer

Imports
Exports
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Fuel ethanol in Asia/Pacific

- Thailand: tax reductions, investments subsidies.
- China: mandate in some regions.
- Australia: tax exemption, direct support.
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The 2002 supply/demand balance in Asia/Pacific

Importers

Exporters

Japan  S Korea  Singapore  Philippines  Taiwan  Brazil  China  Thailand  S Arabia  USA  Australia  India  Argentina
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Current suppliers in Asia/Pacific

- Current suppliers with potential
  - Brazil
  - Thailand
  - India
  - South Africa
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Future suppliers in Asia/Pacific

• Future suppliers with potential
  ➢ Peru
  ➢ Central America
  ➢ Colombia
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The Mega-Project in Peru

• Domestic and international effects
  ➢ Introduce E-10
  ➢ Replace MTBE/lead
  ➢ Fight coca (cocaine)
  ➢ Export to the US under Andean Pact
  ➢ Export to Japan
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Export potential under the Mega-Project

Exports

-1400000
-1200000
-1000000
-800000
-600000
-400000
-200000
0

2004 2005 2006 2007 2008 2009 2010
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Central America

• Domestic and international effects
  ➢ Introduce E-10
  ➢ Replace MTBE/lead
  ➢ Provide alternative outlet for sugar cane
  ➢ Export to the US under CBI
  ➢ Export to Japan (?)
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Colombia

• Domestic and international effects
  ➢ Introduce E-10
  ➢ Replace MTBE/lead
  ➢ Exports ?
World Trade in Fuel Ethanol 1990s
World Trade in Fuel Ethanol in the Future
World Fuel Ethanol Imports
By country (very optimistic scenario)
World Fuel Ethanol Imports

By country (optimistic scenario)
World Fuel Ethanol Imports vs. beverage and industrial ethanol trade
World Fuel Ethanol Production
By country
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Conclusions

• World production will continue to grow strongly
• Trade will grow as well but pace will depend on
  • The sugar-alcohol economics
  • New investments in origins
  • Establishment of a viable trading system (futures)
  • Solution of the subsidy issue
• Overall outlook is very bright