



# **APEC Biofuels Task Force and Asia-Pacific Context for Biofuels Standards Work**

**2nd International Conference on Biofuels  
Standards**

**Standards and Measurements for Biofuels:  
Facilitating Global Trade**

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# APEC Biofuels Context

- ❑ The 21 APEC economies account for roughly half the world's energy use and environmental emissions.
- ❑ Indonesia and Malaysia have major biodiesel potential with planned expansion of palm and jatropha.
- ❑ Substantial potential exists for both diesel and ethanol in countries like Thailand, and Vietnam.
- ❑ Australia and China have lots of coastal area and waste streams suitable for production of biodiesel from algae.
- ❑ The United States has recently overtaken Brazil as the world's leading producer of ethanol.

# Strategic Interest of Biofuels in the Asia Pacific Region

- More oil becomes available for export from the region (examples: Malaysia and perhaps Indonesia again)
- Importers can start to diversify transport sectors away from reliance on oil, reducing dependency on Middle East (Examples: Japan, Korea, Chinese Taipei)
- Very substantial resources are being devoted to biofuels development, with a very real economic and strategic potential at today's oil prices.

# Biodiesel from Palm in Malaysia

- In Malaysia, the Task Force found that biodiesel from palm oil could be produced for about US\$0.38 per liter:
  - 26 cents in feedstock cost,
  - 6 cents in capital plant cost, and
  - 6 cents for labor and O&M, with a
  - <0.5 cent credit for glycerine co-product.
- Competes with \$42/barrel crude.
- Some 16.3 billion liters or 13.9 million tons of diesel potential could displace 70% of 2002 petroleum demand or 27% of oil demand projected for 2030.

# Biodiesel from Jatropha in Indonesia

- Indonesia can produce biodiesel from jatropha for around US\$0.44 to US\$0.48 per liter:
  - 37 cents for feedstock
  - 8 cents for capital plant cost assuming 10% cost of capital, 10-year plant life (or 4 cents assuming a 5% capital cost and 20-year plant life for mature plants)
  - 3 cents in labor and operating costs
  - No credits for byproducts
- Competes with crude at \$52 to \$58 per barrel
- Biodiesel from palm oil is cheaper, around 39-41 cents per liter, competitive with crude at \$44 to \$47 per barrel.

# Notable Points on APEC Biodiesel

- Biodiesel from palm and jatropha in APEC are much more economical and have much greater resource potential than “traditional” biodiesel from crops like soybeans and rapeseed in the USA and Europe.
- Since technical characteristics of biodiesel from palm are far from ideal, especially in cold weather, performance-based standards (effectively allowing palm blends) are essential if trade is to evolve: prescriptive standards (prohibiting biodiesel with characteristics matching palm) would kill trade.

# **2007 APEC Project on Guidelines for Development of Biodiesel Standards**

- By establishing guidelines for development of biodiesel standards in the APEC region, the project aims to enhance the potential for biodiesel trade among APEC member economies.**
- Project is being led by Thailand while Australia, Chinese Taipei, New Zealand and US co-sponsor.**
- Project was developed through APEC Expert Group on New and Renewable Energy Technologies, in cooperation with the APEC Biofuels Task Force.**

# Introductory Points on Asian Biodiesel

- ❑ The quality of biodiesel produced depends on the natural characteristics of feedstocks, which include a variety of animal fats and vegetable oils.
- ❑ EN 14214:2003 and ASTM D 6751:2003 are the standards currently used
- ❑ The feedstocks used in EU and US are different from those used in much of the APEC region, so standards need to take them into account.

# Fatty acids in Thailand/APEC Biodiesel

Fatty acid	BDF from						
	Crude palm oil	Crude coconut oil	Jatropha oil	Palm stearin	Palm olein	Soybean oil	Sunflower oil
Caproic acid, C8:0	-	7.42	-	-	-	-	-
Capric acid, C10:0	-	5.78	-	-	-	-	-
Lauric acid, C12:0	0.35	49.75	-	0.25	0.37	0.1	-
Myristic acid, C14:0	0.92	18.75	-	1.27	0.91	0.2	0.1
Palmitic acid, C16:0	44.11	8.60	14.85	59.19	38.53	10.7	6.0
Stearic acid, C18:0	4.36	2.65	7.43	4.43	0.08	3.9	4.0
Arachidic acid, C20:0	0.09	0.18	0.08	0.31	0.13	Other = 0.2	Other = 1.1
<b>Sum of Saturated FA</b>	<b>49.83</b>	<b>93.13</b>	<b>22.36</b>	<b>65.45</b>	<b>40.02</b>	<b>15.1</b>	<b>11.2</b>
Palmitoleic acid, C16:1	-	-	-	0.08	-	0.3	<1.0
Oleic acid, C18:1	38.97	5.53	47.65	28.61	58.13	22.8	16.5
Linoleic acid, C18:2	11.21	1.26	29.80	5.86	1.78	50.8	72.4
Linolenic acid, C18:3	-	0.07	0.19	-	0.07	Other = 6.8	Other = 0.6
<b>Sum of Unsaturated FA</b>	<b>50.18</b>	<b>6.86</b>	<b>77.64</b>	<b>34.55</b>	<b>59.98</b>	<b>80.7</b>	<b>90.5</b>

# APEC Biofuel Standards – Work Plan

<b>Phase 1:</b>	<b>Review the current biodiesel standards applied in both APEC economies and non-APEC economies. Review the potential feedstocks and evaluate how their natural characteristics may affect the quality of biodiesel.</b>	<b>3 months</b>
<b>Phase 2:</b>	<b>Review lessons learned on the effect of biodiesel on diesel engines and vehicles including their emissions. Review the opportunities, gaps, barriers and lessons learned from using biodiesel with engine and automobile manufacturers in order to adopt specifications for biodiesel and biodiesel blends. Investigate the additives and antioxidants necessary for biodiesel. Organize the first workshop in Thailand (October 2007)</b>	<b>7 months</b>

# APEC Biofuel Standards – Work Plan

<b>Phase 3:</b>	<b>Integrate and synthesize the information obtained from phase 1 and 2.</b>	<b>10 months</b>
<b>Phase 4:</b>	<b>Organize the second workshop in Chinese Taipei with representatives from the energy sector in APEC economies. (Workshop took place in May 2008). The recommendation and the lessons learned from stakeholders will be shared for future practice.</b>	<b>13 months</b>
<b>Phase 5:</b>	<b>Integrate and synthesize the information for final report.</b>	<b>17 months</b>
<b>Phase 6:</b>	<b>Draft final report on the guidelines</b>	<b>20 months</b>

# The First Workshop in Thailand\_ October 25-26, 2007

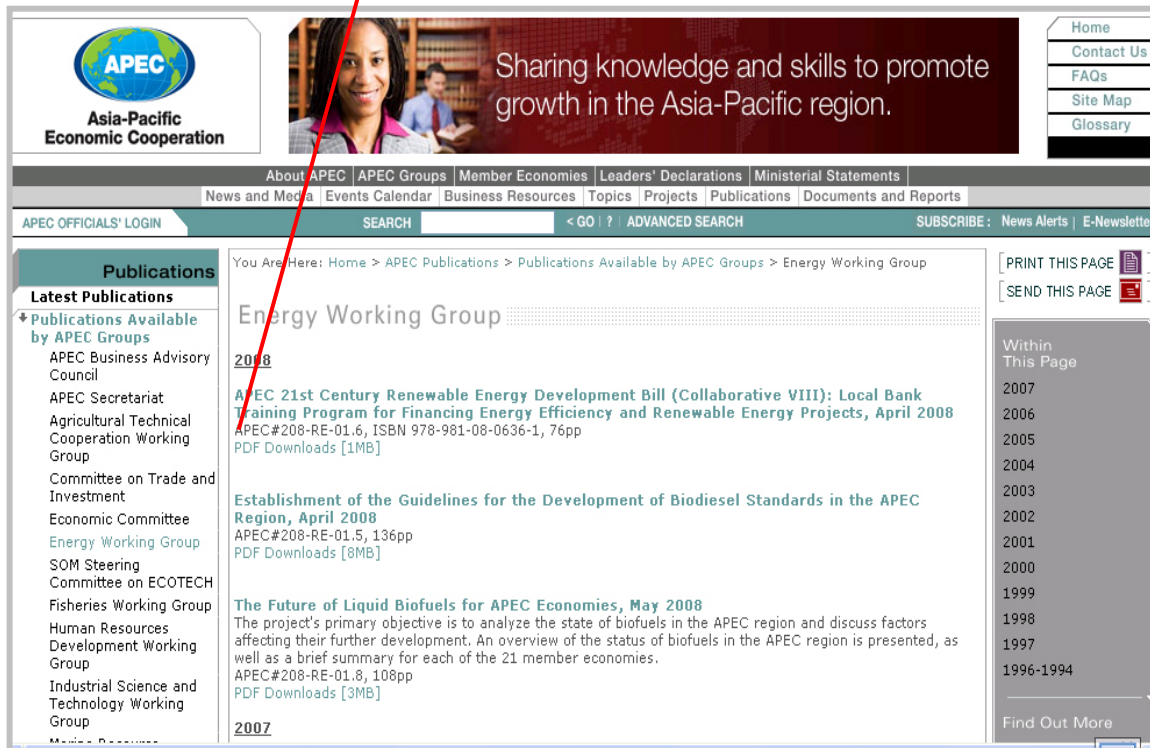


# Thailand Workshop, October 2007

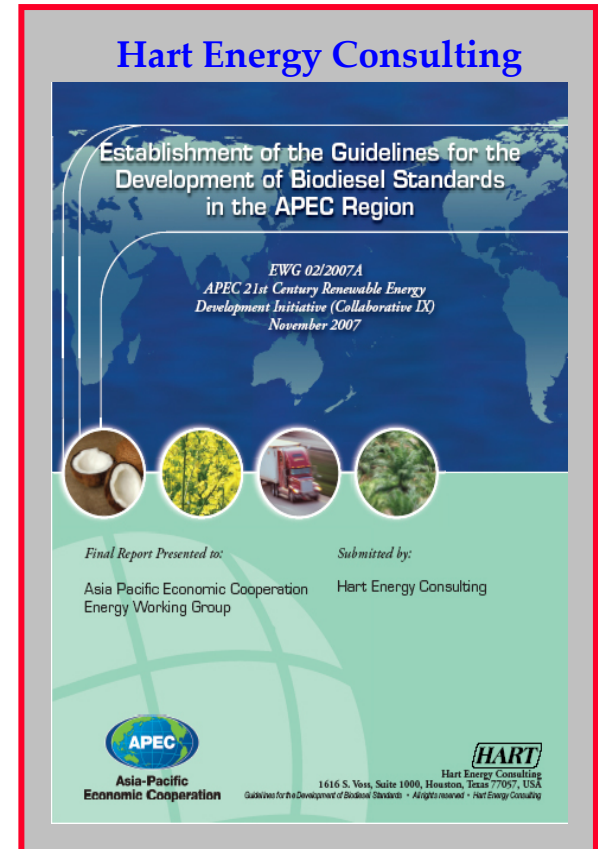
<b>No. of APEC and non-APEC Economies:</b>	15	
	<ol style="list-style-type: none"> <li>1. Australia</li> <li>2. Canada</li> <li>3. China</li> <li>4. Chinese Taipei</li> <li>5. Hong Kong</li> <li>6. Indonesia</li> <li>7. Japan</li> <li>8. Korea</li> </ol>	<ol style="list-style-type: none"> <li>9. Malaysia</li> <li>10. New Zealand</li> <li>11. Philippines</li> <li>12. Singapore</li> <li>13. South Africa</li> <li>14. Thailand</li> <li>15. USA</li> </ol>
<b>No. of Participants:</b>	90	
	<input type="checkbox"/> Government agencies	<input type="checkbox"/> Oil company
	<input type="checkbox"/> Biodiesel producers	<input type="checkbox"/> User
	<input type="checkbox"/> Engine/vehicle producers	
<b>No. of Presentations:</b>	15	

# Current Project Output

[http://www.apec.org/apec/publications/all\\_publications/energy\\_working\\_group.html](http://www.apec.org/apec/publications/all_publications/energy_working_group.html)



The screenshot displays the APEC website's 'Energy Working Group' publications page. At the top left is the APEC logo and the text 'Asia-Pacific Economic Cooperation'. A banner image shows a woman smiling, with the text 'Sharing knowledge and skills to promote growth in the Asia-Pacific region.' To the right of the banner are navigation links: Home, Contact Us, FAQs, Site Map, and Glossary. Below the banner is a horizontal menu with categories like 'About APEC', 'APEC Groups', 'Member Economies', etc. A search bar and 'APEC OFFICIALS' LOGIN' are also visible. The main content area is titled 'Energy Working Group' and lists publications from 2008 and 2007. The 2008 publications include 'APEC 21st Century Renewable Energy Development Bill (Collaborative VIII): Local Bank Training Program for Financing Energy Efficiency and Renewable Energy Projects, April 2008' and 'Establishment of the Guidelines for the Development of Biodiesel Standards in the APEC Region, April 2008'. The 2007 publication is 'The Future of Liquid Biofuels for APEC Economies, May 2008'. A sidebar on the right offers options to 'PRINT THIS PAGE' or 'SEND THIS PAGE', and a 'Within This Page' section with a year list from 2007 to 1996-1994.



The image shows the cover of a report titled 'Establishment of the Guidelines for the Development of Biodiesel Standards in the APEC Region'. The cover features a world map background and four circular images: two eggs, a field of yellow flowers, a red truck, and a green plant. The text on the cover includes 'EWG 02/2007A', 'APEC 21st Century Renewable Energy Development Initiative (Collaborative IX)', and 'November 2007'. It also states 'Final Report Presented to: Asia Pacific Economic Cooperation Energy Working Group' and 'Submitted by: Hart Energy Consulting'. At the bottom, there are logos for APEC and HART, along with the address '1616 S. Voss, Suite 1000, Houston, Texas 77057, USA' and a disclaimer: 'Guidelines for the Development of Biodiesel Standards • All rights reserved • Hart Energy Consulting'.

# APEC Biodiesel Quality Standard and Harmonization Initiative (1)

Description	ASTM D 6751	EN 14214	Typical APEC Economy	Discussion & Conclusion
<b>Regulatory and Emissions</b>				
Max Sulphur, ppm	15/500	10	10-500	<ul style="list-style-type: none"> <li>▪ Regulatory require per economy</li> <li>▪ Buyer-seller specified</li> </ul>
Min Flash Point, °C	130/93	120	93-130	<ul style="list-style-type: none"> <li>▪ For non-hazardous classification in US min of 93°C is required</li> <li>▪ To show methanol controlled certify at &gt; 130°C</li> </ul>
Max T90 Distillation, °C	360	-	Philippines, Australia, Indonesia 360°C	<ul style="list-style-type: none"> <li>▪ Other performance test control contaminants</li> <li>▪ Biodiesel reduces PM and HC emission so test not required for emission reasons</li> </ul>

# APEC Biodiesel Quality Standard and Harmonization Initiative(2)

Description	ASTM D 6751	EN 14214	Typical APEC Economy	Discussion & Conclusion
<b>Engine and After Treatment Performance (1)</b>				
Cetane Number	47	51	47-51	<ul style="list-style-type: none"> <li>▪ Higher than 47 (EN) is required for emissions. This is based on diesel tests, so not necessarily applicable to biodiesel</li> <li>▪ Higher minimum ambient temperature reduces start-up emissions.</li> <li>▪ Blending not necessarily linear</li> <li>▪ Additives can be used</li> </ul>
Min-Max Density at 15° C, kg/m <sup>3</sup>	-	860-900	820-900	<ul style="list-style-type: none"> <li>▪ Agreement</li> </ul>
Min Viscosity at 40°C, cSt	1.9-6.0	3.5-5.0	1.9-3.5 min 4.5-6.0 max	<ul style="list-style-type: none"> <li>▪ Coconut below 3.5, tallow and palm can exceed 5</li> <li>▪ Requirement should be for the final blend</li> </ul>
Max Phosphorus, ppm	10	10	10 China no spec	<ul style="list-style-type: none"> <li>▪ Agreed</li> </ul>

# APEC Biodiesel Quality Standard and Harmonization Initiative(3)

Description	ASTM D 6751	EN 14214	Typical APEC Economy	Discussion & Conclusion
<b>Engine and After Treatment Performance (2)</b>				
Max Group I metals (Na+K), ppm	5.0	5.0	Report 5, no spec	<ul style="list-style-type: none"> <li>▪ Depends on after treatment</li> </ul>
Max Group II metals (Ca+Mg), ppm	5.0	5.0	Report 5, no spec	<ul style="list-style-type: none"> <li>▪ Depends on after treatment</li> </ul>
Max CFPP, °C	-	+5 to -44	No spec Chinese Taipei= 0 Indonesia= +18	<ul style="list-style-type: none"> <li>▪ Requirement should be for the blend</li> </ul>
Max cloud point, °C	Report	-	No spec Philippines = report	<ul style="list-style-type: none"> <li>▪ Not needed</li> </ul>

# APEC Biodiesel Quality Standard and Harmonization Initiative(4)

Description	ASTM D 6751	EN 14214	Typical APEC Economy	Discussion & Conclusion
<b>Direct Usability and /or Durability (1)</b>				
Max Carbon Residue, on 10% distillation residue, % wt	-	0.3	0.1-0.3 Philippines no spec	<ul style="list-style-type: none"> <li>▪ Difficult for biodiesel to fractionate 10%, so not recommended</li> </ul>
Max Carbon Residue, on 100% sample, % wt	0.05	-	Korea, Chinese Taipei, Thailand, Japan, China = no spec	<ul style="list-style-type: none"> <li>▪ Recommended to use</li> </ul>
Max Water and sediment, % vol	0.05	-	Japan, NZ, Chinese Taipei, Thailand, China= no spec	<ul style="list-style-type: none"> <li>▪ Agreed to replace by separate testing</li> </ul>
Max Water % wt.	-	0.05	Australia, Indonesia. Philippines, Korea= no spec	<ul style="list-style-type: none"> <li>▪ Agreed</li> </ul>
Max Sulfated Ash, % wt	0.02	0.02	0.01-0.02	<ul style="list-style-type: none"> <li>▪ Agreed at 0.02</li> <li>▪ May reduce later</li> </ul>
Max Total Contaminate, % wt	-	.0024	China, Indonesia, Philippines, Korea= no spec	<ul style="list-style-type: none"> <li>▪ Agreed</li> </ul>

# APEC Biodiesel Quality Standard and Harmonization Initiative(5)

Description	ASTM D 6751	EN 14214	Typical APEC Economy	Discussion & Conclusion
<b>Direct Usability and /or Durability (2)</b>				
Max Copper Strip Corrosion, 3 hr at 50°C	3	1	1 Indonesia, Philippines = 3	▪ Needs further work for alignment. In practice biodiesel complies easily
Max Methanol Content, % wt.	0.2	0.2	China, Philippines = no spec	▪ Agreed
Max Free glycerin, % wt.	0.02	0.02	Korea= no spec	▪ Agreed
Max Total glycerin, % wt.	0.24	0.25	0.24-0.25	▪ Agreed and 0.24 recommend
Min Oxidation Stability at 110°C, hrs	3	6	No spec 3-6 Japan =10	▪ Needs further work

# APEC Biodiesel Quality Standard and Harmonization Initiative (6)

Description	ASTM D 6751	EN 14214	Typical APEC Economy	Discussion & Conclusion
<b>Indirect (Derived) Usability and/or Durability</b>				
Min Methyl Ester Content, % wt	-	96.5	China Philippines, US= no spec	<ul style="list-style-type: none"> <li>▪ Method developed for RME, so does not show lower molecular weight from CME</li> </ul>
Max Acid Value, mg KOH/g	0.50	0.50	0.50-0.8	<ul style="list-style-type: none"> <li>▪ Simple test. Agreed to include</li> <li>▪ Limit not agreed</li> </ul>
Max Glycerides % wt _ mono, di, tri,	-	0.8, 0.2, 0.2	No spec	<ul style="list-style-type: none"> <li>▪ No agreement</li> <li>▪ Prefer direct tests of performance</li> </ul>
Max Linolenic Acid Methyl Ester, %wt	-	12.0	Australia, China, Indonesia, Philippines, Korea, US= no spec	<ul style="list-style-type: none"> <li>▪ Limit certain feedstocks with no clear reason</li> <li>▪ No agreement</li> <li>▪ Prefer direct tests of performance</li> </ul>
Max Polyunsaturated ME	-	1	No spec Chinese Taipei=1	<ul style="list-style-type: none"> <li>▪ No agreement</li> <li>▪ Prefer direct tests of performance</li> </ul>
Max Iodine Value, g Iodine/100 g	-	120	115-120 Australia, China, Philippines, Korea, US= no spec	<ul style="list-style-type: none"> <li>▪ Limits certain feedstocks without certain reason. Max limit of 130 preferred</li> <li>▪ No agreement</li> <li>▪ Prefer direct tests of performance</li> </ul>

# Take-Away's from APEC Biodiesel Efforts from ASTM Biodiesel TF Chairman

- Regional Biodiesel Specifications Are Desirable
  - Many APEC economies may not need the stringent limits adopted by the US and Europe (BD, petro)
  - Emissions and engine technology vary vs. US/EU
- The B100 specifications are dependent on the final blend level to be used or targeted
  - i.e. B100 pure fuel use is much different than B20/B5
- Specifications should be based on performance, not on identifying specific compounds which impact performance
  - i.e. specify oxidation stability rather than iodine number, poly-unsaturates, linolenic acid concentration, etc.

# Take-Away's from APEC Biodiesel Efforts from ASTM Biodiesel TF Chairman

- Some changes to ASTM/CEN Limit Values or Test Methods are needed for some APEC Biodiesel
  - i.e. coconut
  - Changes are minor and ASTM encourages proposals from APEC economies, embraces leaders from APEC economies to accomplish these changes
  - Changes worked through the normal ASTM process.
  - ASTM specifications are intended to be feedstock and process neutral within scope of D6751 (i.e. mono alkyl esters from vegetable oils/animal fats)
- APEC economies are divided on target blend level of biodiesel that engine companies should plan for:
  - Several B5, USA B20, Malaysia B50/B100

# Take-Away's from APEC Biodiesel Efforts from ASTM Biodiesel TF Chairman

- Once individual countries set specifications, ongoing monitoring for quality and enforcement of specifications is quite important, i.e. BQ-9000 quality program
  - Government resources most likely needed here
- There is a need for 'quick and simple' field tests for biodiesel quality and for percent biodiesel in the fuel
  - Sophisticated laboratories are not frequently available in some APEC economies
- Information sharing has been extremely valuable, especially for those new to biodiesel
  - No need to re-discover what is already known

# Contact Information for Project Leader

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