Appendixes

Appendix A

Related Publication

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki (2010) Emissions estimation and reduction strategies for road transport in Malaysia. 8th Asia Pacific Transportation Development Conference, Tainan, Taiwan. 28 May 2010.

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki (2011) A review on energy scenario and sustainable energy in Malaysia *Renewable and Sustainable Energy Reviews*, Vol 15 (1) Pg: 639-647.

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki, R.S. Norhasyima (2011) Comparison of Palm oil, Jatropha curcas and Calophyllum Inophyllum for Biodiesel. *Renewable and Sustainable Energy Reviews*, Vol 15 (6) Pg: 3501– 3515.

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki (2011) A review on emissions and mitigation strategies for road transport in Malaysia. *Renewable and Sustainable Energy Reviews*, Vol 15 (6) Pg: 3516– 3522.

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki (2012) A review on energy pattern and policy for transportation sector in Malaysia. *Renewable and Sustainable Energy Reviews*, 16 (1) Pg: 532– 542

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki, D. Honnery (2012) Life cycle cost and sensitivity analysis of palm biodiesel production. *Fuel*, http://dx.doi.org/10.1016/j.fuel.2012.03.031

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki. Biodiesel production from crude palm oil, Jatropha curcas and Calophyllum inophyllum oil as biofuel. (Applied Energy:APEN-D-12-01847)

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki. Biodiesel production from crude calophyllum inophyllum seed oil with high free fatty acid content. (Energy: EGY-D-12-01607)

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki. Techno-economic and sensitivity analysis of jatropha and calophyllum inophyllum biodiesel production. (Applied Energy: APEN-D-12-02625)

H.C. Ong, T.M.I. Mahlia, H.H. Masjuki. Energy and emission reduction from palm, jatropha curcas and calophyllum inophyllum biodiesel as biofuel for road transport. (Atmospheric Environment: ATMENV-S-12-02015)

Appendix B: Invitation letter from JARI (Japanese Automobile Research Institute)

JARI

November 4th, 2011
Tsukuba, Japan

To,
Professor H. C. Ong

Department of Mechanical Engineering,
University of Malaya,
50603 Kuala Lumpur

Dear Prof. H. C. Ong

Japan Automobile Research Institute (JARI), awarded a project "Energy Saving Promotion Project in Asian countries in ERIA project" by Ministry of Economies, Trade and Industry, Government of Japan (METI), is pleased to provide an opportunity for meeting to discuss and exchange information and opinion in relation to solving the environment and energy problems arising from motorized transportation.

The project aims to exchange opinion with experts on preparation of comparative studies on energy/environmental policies and automobile statistical data collection in ASEAN countries. We plan to visit your office on November 30th (Wednesday) at 13H30, 2011. We believe that it is very important to support for data collection procedures for the transport sector which will of future co-benefit.

On behalf of Japan Automobile Research Institute, we would like to request that someone from your good office in Kuala Lumpur could explain about energy saving policy (bio diesel, fuel efficiency economy standard and fuel economy regulation in Malaysia (tentative). We would be most honored if you would reserve the date and plan to attend at this important event. We would appreciate receiving your confirmation by sending an e-mail to JARI staff Ms.Keiko Hirota (khirota@jari.or.jp) as soon as conveniently possible.

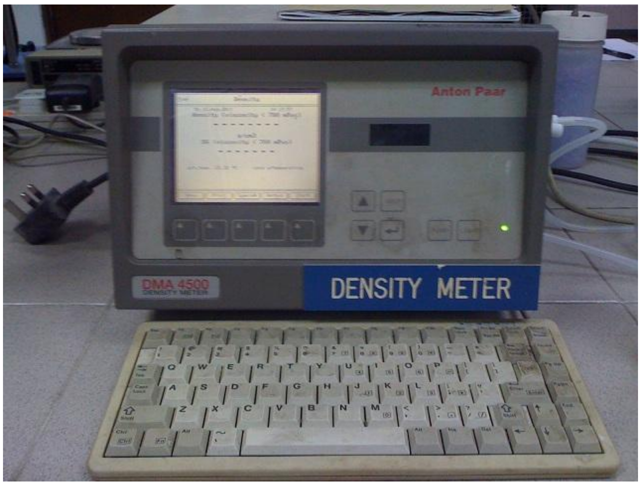
Sincerely yours,
Asian Strategy Laboratory
Environmental Policy Analysis
Keiko Hirota, Dr. Eng.

2530 Karima Tsukuba Ibaraki 305-0822 Ibaraki, Japan
Japan Automobile Research Institute
Tel: +81-29-856-0767 Fax: +81-29-860-2388

Appendix C: Figures of biodiesel properties test

Density test

Equipment: Anton Paar –DMA 4500 density meter



Kinematic viscosity

Equipment: Anton Paar SVM 3000 viscometer

Flash point

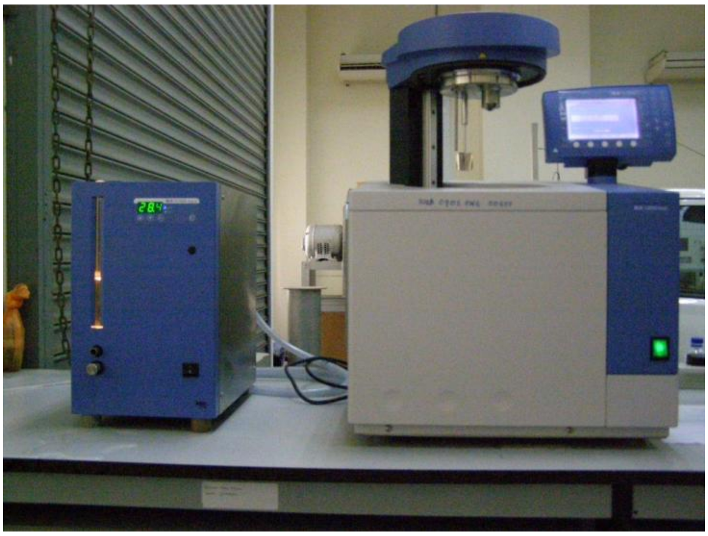
Equipment: Petrotest –PM 4 flash point tester

Water content test

Equipment: Metrohm- KF 831 coulometer

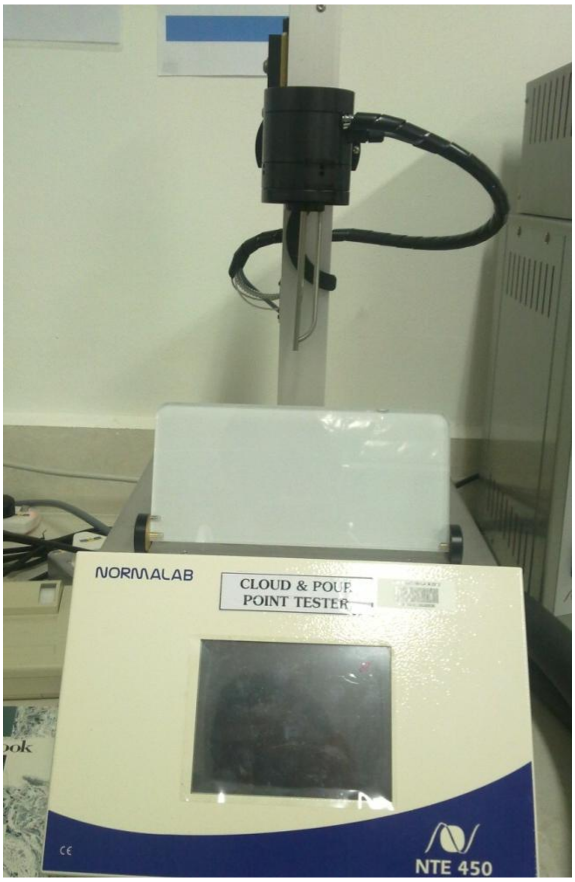
Calorific value

Equipment: Bomb calorific meter IKA C2000



Cloud point and Pour

Equipment: Normalab-NTE 450 Cloud point and Pour tester



Copper strip corrosion

Equipment: Stanhope-Seta

Appendix D

Table A.1: Estimates of carbon stocks for tropical landscapes (Gibbs et al., 2008).

Biomass Carbon of Tropical Land Cover Types (t C / ha)												
	Americas			Sub-Saharan Africa			Southeast Asia[2]			Pan-Tropical		
Crop Type	Humid	Seasonal	Dry	Humid	Seasonal	Dry	Humid	Seasonal	Dry	Humid	Seasonal	Dry
Forests	197	132	130	204	156	76	229	109	82	210	132	96
Disturbed Forests[3]	100	68	67	104	80	40	116	56	43	107	68	50
Shrubland / Savanna	64	43	42	67	51	24	75	35	26	69	43	31
Grassland	8	8	4	8	8	4	8	8	4	8	8	4
Degraded Land[4]	1	1	1	1	1	1	1	1	1	1	1	1
Annual Cropland[5]	6	7	7	4	3	5	5	5	5	5	5	5
Sugarcane[6]	11	14	15	5	9	14	13	13	14	10	12	14
Oil Palm[7]	71	79	72	17	23	45	88	77	77	58	60	65
Coconut[8]	95	93	93	68	41	29	67	66	74	77	66	65

All values include carbon stored in aboveground and belowground living plant biomass (tC/ha)[1, 2]

1. Humid, seasonal and dry ecoregions were defined according to the FAO Global Ecoflorisitic zones. The dry ecoregions includes both dry tropical forests and shrublands. Mountain ecoregions were included as humid tropics in Southeast Asia and dry tropics in Africa and Latin America. All biomass carbon values estimated using IPCC Tier-1 methods. Estimates include litter and dead wood carbon stocks for forests.

2. Used insular Southeast Asia value for humid forests and continental Southeast Asia values for seasonal and dry forests based on patterns of forest distribution

3. Forest carbon values were reduced by 50% to estimate disturbed forest biomass (i.e. affected by shifting cultivation, logging, fragmentation, fire etc.)

4. Assumed that degraded lands have very little living biomass.

5. To estimate biomass for annual crops, we assigned 5 tC/ ha to the mean tropical yield for annual crops and then scaled according to regional yields. Ratios of average pan-tropical yield / regional yields (0.85, 0.73, 0.76 for Americas, 1.41, 1.45, 1.11 for Africa, and 1.01, 0.99, 1.10 for Asia).

6. Assumed sugarcane stored 14 t C / ha in seasonal Americas. Scaled across the tropics using ratios of Africa and Southeast Asia / seasonal Americas yield data (0.82 and 1.07 for humid and dry Americas and 0.33, 0.67 and 0.97 for humid, seasonal and dry Africa, and 0.95, 0.93, and 0.98 for humid, seasonal and dry Southeast Asia, respectively

7. Oil palm value based on average IPCC GPG value for humid Southeast Asia, we used 0.47 for C fraction and then added in root biomass according to IPCC. Scaled across tropics using ratios of Africa and Americas / humid Southeast Asia yield data (0.81, 0.91, 0.82 for humid, seasonal and dry Americas and 0.19, 0.26 and 0.51 for humid, seasonal and dry Africa, and 0.87 and 0.88 for seasonal and dry Southeast Asia, respectively).

8. Coconut value based on best guess for humid Southeast Asia, we used 0.47 for C fraction and then added in root biomass according to IPCC. Scaled using ratios of Africa and Americas / humid Southeast Asia yield data (1.41, 1.37, 1.38 for humid, seasonal and dry Americas and 1.0, 0.61 and 0.44 for humid, seasonal and dry Africa, and 0.98 and 1.10 for seasonal and dry Southeast Asia, respectively).

Appendix E

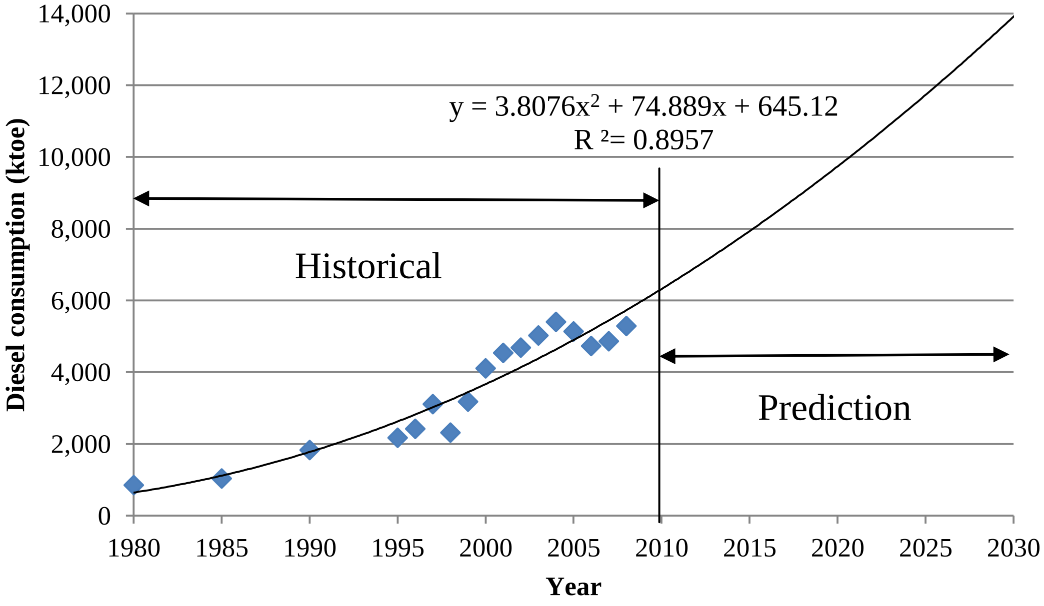


Figure A.1: Historical data and predicted diesel fuel consumption trend for transportation sector from 1980 to 2031 in Malaysia.