

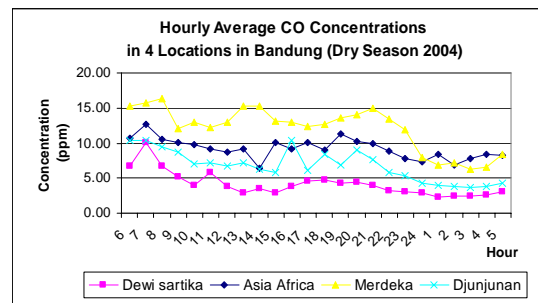
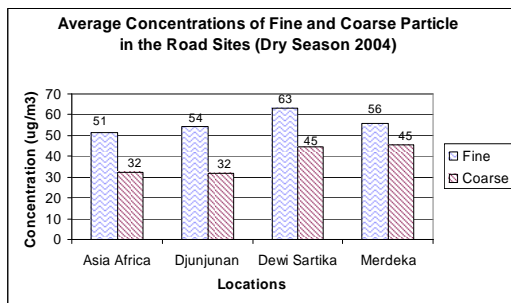
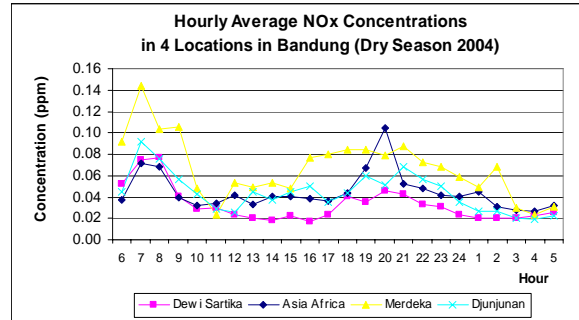
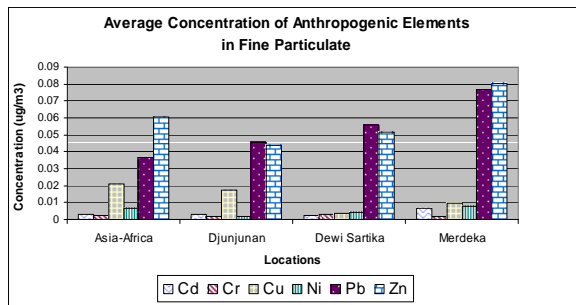
Vehicle Emissions Testing in Bandung – Progress on Indonesian AIRPET Project

Puji Lestari

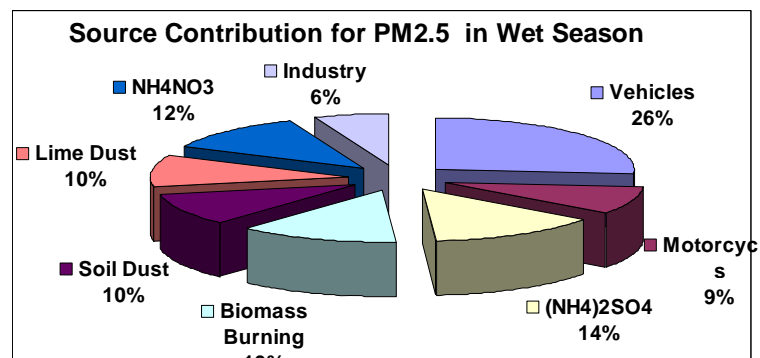
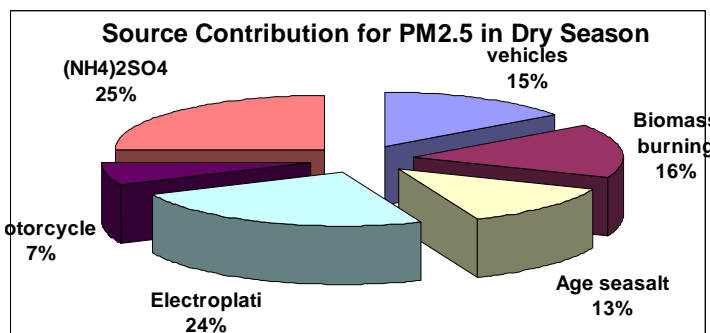
Faculty of Civil and Environmental Engineering
Institute of Technology Bandung (ITB)
Indonesia



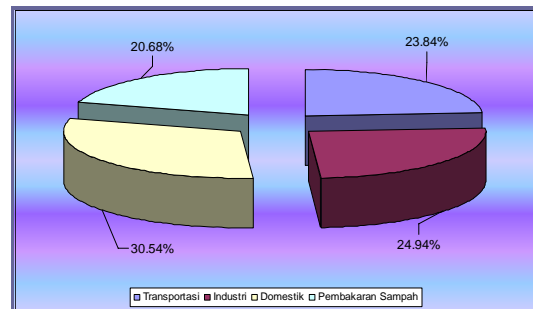
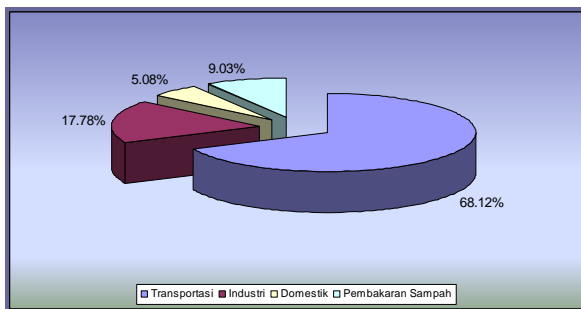
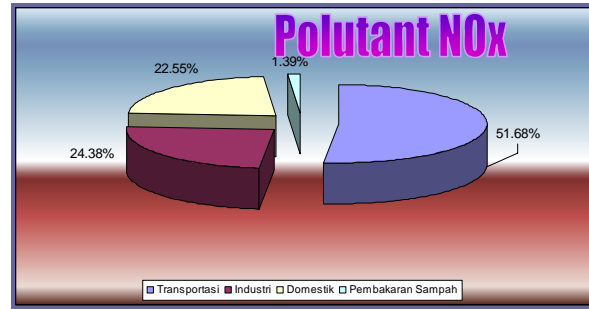
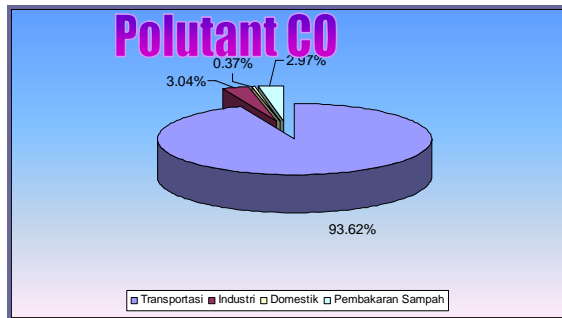
Problem Identification: Results from Road Sites Monitoring



Problem Identifications: Source Contribution Results from PMF



Problem Identifications: Results of Emission Inventory in Bandung based on 2002 Data



Integrated Air Quality Management for Vehicle Emission

Progress on Indonesia's AIRPET Project

Airpet Indonesia: Integrated Air Quality Management for Vehicle Emission

- ❑ BLL test for School Children and public campaign
- ❑ **Begin with Vehicle Emission Test in Bandung**
- ❑ Development of Source Profile
 - Diesel Engine car and
 - Motor cycles
 - Cars using Bio-ethanol fuel
- ❑ Participate in policy development in Bandung
 - Involving in Development AAQS in West Java
 - Involvement in Developing Emission standard for Vehicles



Vehicle Emission Test in Bandung

- ❑ Begin with Emission test for Government officer at the Governor office
- ❑ BLL test & Emission Test at the City Major office with LIC and ASBEKINDO
- ❑ Emission Test using a Chasis Dynamometer:
 - Diesel and gasoline vehicles
 - Vehicles with Bio fuels
 - Emission Factor
 - Source Profiles



BLL and Emission Test in 2005 at City Major Office with LIC and Asbekindo



Chasis Dynamometer Test



Emission Test: Biodiesel/Bio-Ethanol Cars

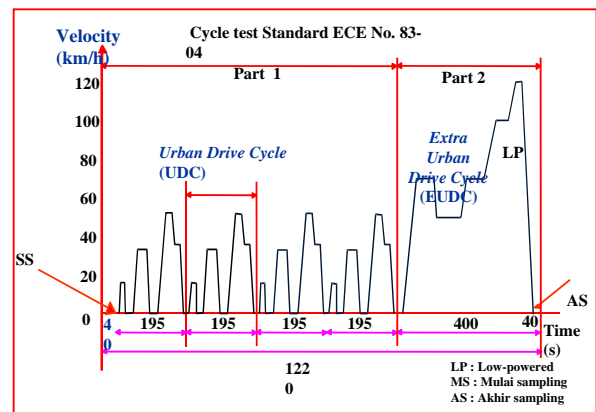


- Type of Cars:
 - Diesel cars
 - Direct Injections
 - Common Rail
 - Gasoline Cars
 - Electrical Fuel Injection
 - Carburetor system

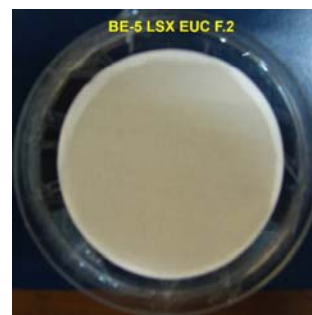
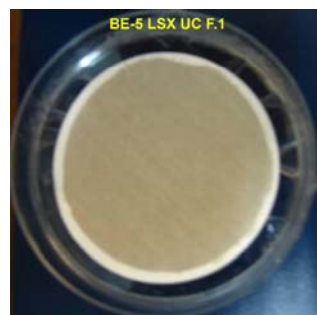
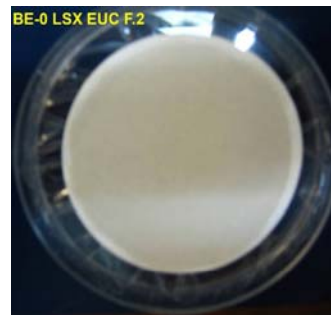
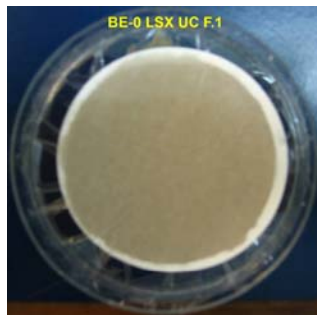


Driving Cycles: Urban and Extra Urban

- *MS Urban Drive Cycle (UDC)LP*
2040608010012001951951951
95400 Waktu (s)LP : Low-powered
- SS : Start Sampling
- LS : Last sampling Part 1Part 2Velocity (km/h)401220 Cycle test Standard ECE No. 83-04
Extra Urban Drive Cycle (EUDC)40AS



Results from Urban and Extra Urban Cycles



Emission: (Electrical Fuel Injection)

HASIL PENGUJIAN PADA TOYOTA KIJANG INNOVA

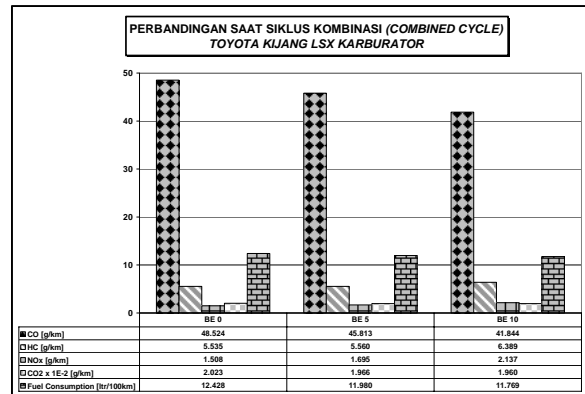
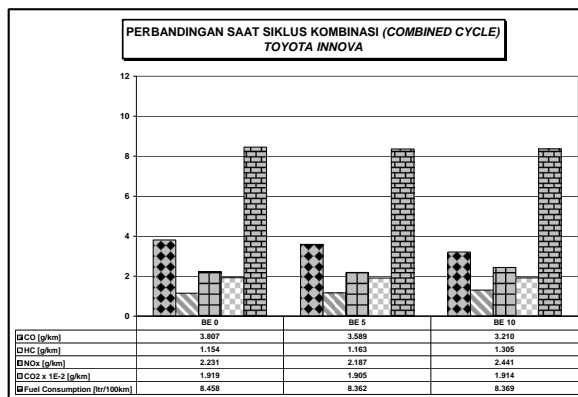
BE 0			BE 5			BE 10		
URBAN			URBAN			URBAN		
CO	[g/km]	5.117	CO	[g/km]	4.837	CO	[g/km]	4.860
HC	[g/km]	2.005	HC	[g/km]	2.021	HC	[g/km]	2.358
NOx	[g/km]	1.701	NOx	[g/km]	1.681	NOx	[g/km]	1.918
HC+NOx	[g/km]	3.706	HC+NOx	[g/km]	3.701	HC+NOx	[g/km]	4.276
CO2	[g/km]	238.972	CO2	[g/km]	237.031	CO2	[g/km]	237.577
FC	[l/100 km]	10.635	FC	[l/100 km]	10.507	FC	[l/100 km]	10.545
EXTRA URBAN			EXTRA URBAN			EXTRA URBAN		
CO	[g/km]	3.044	CO	[g/km]	2.836	CO	[g/km]	2.250
HC	[g/km]	0.658	HC	[g/km]	0.666	HC	[g/km]	0.692
NOx	[g/km]	2.539	NOx	[g/km]	2.480	NOx	[g/km]	2.745
HC+NOx	[g/km]	3.197	HC+NOx	[g/km]	3.146	HC+NOx	[g/km]	3.437
CO2	[g/km]	164.427	CO2	[g/km]	163.450	CO2	[g/km]	164.451
FC	[l/100 km]	7.190	FC	[l/100 km]	7.116	FC	[l/100 km]	7.102
COMBINED			COMBINED			COMBINED		
CO	[g/km]	3.807	CO	[g/km]	3.571	CO	[g/km]	3.210
HC	[g/km]	1.154	HC	[g/km]	1.163	HC	[g/km]	1.305
NOx	[g/km]	2.231	NOx	[g/km]	2.187	NOx	[g/km]	2.441
HC+NOx	[g/km]	3.384	HC+NOx	[g/km]	3.350	HC+NOx	[g/km]	3.746
CO2	[g/km]	191.856	CO2	[g/km]	190.473	CO2	[g/km]	191.358
FC	[l/100 km]	8.458	FC	[l/100 km]	8.361	FC	[l/100 km]	8.369

Emissions : (Carburetor System)

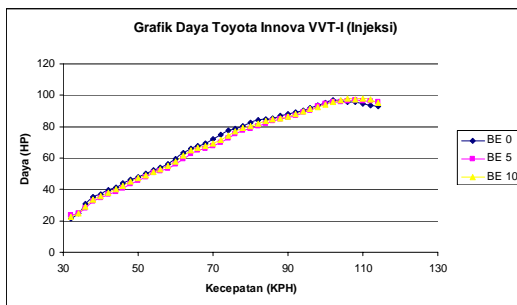
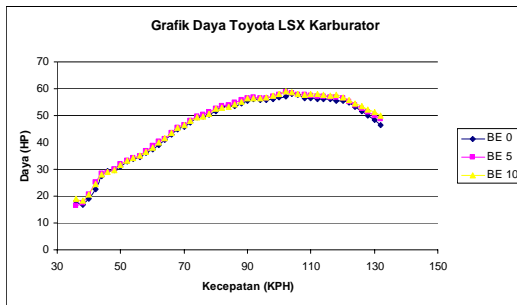
HASIL PENGUJIAN PADA TOYOTA KIJANG LSX

BE 0			BE 5			BE 10		
URBAN			URBAN			URBAN		
CO	[g/km]	77.992	CO	[g/km]	76.571	CO	[g/km]	71.831
HC	[g/km]	7.591	HC	[g/km]	9.734	HC	[g/km]	9.715
N0x	[g/km]	1.058	N0x	[g/km]	1.175	N0x	[g/km]	1.336
HC+N0x	[g/km]	8.649	HC+N0x	[g/km]	10.910	HC+N0x	[g/km]	11.051
CO2	[g/km]	217.914	CO2	[g/km]	212.073	CO2	[g/km]	211.692
CO2	[g/100 km]	2.179	CO2	[g/100 km]	2.121	CO2	[g/100 km]	2.117
FC	[l/100 km]	15.301	FC	[l/100 km]	15.204	FC	[l/100 km]	14.831
EXTRA URBAN			EXTRA URBAN			EXTRA URBAN		
CO	[g/km]	31.272	CO	[g/km]	27.805	CO	[g/km]	24.228
HC	[g/km]	4.331	HC	[g/km]	3.116	HC	[g/km]	4.434
N0x	[g/km]	1.771	N0x	[g/km]	1.999	N0x	[g/km]	2.608
HC+N0x	[g/km]	6.102	HC+N0x	[g/km]	5.116	HC+N0x	[g/km]	7.043
CO2	[g/km]	193.129	CO2	[g/km]	191.134	CO2	[g/km]	186.773
CO2	[g/100 km]	1.931	CO2	[g/100 km]	1.911	CO2	[g/100 km]	1.868
FC	[l/100 km]	10.745	FC	[l/100 km]	10.242	FC	[l/100 km]	9.970
COMBINED			COMBINED			COMBINED		
CO	[g/km]	48.524	CO	[g/km]	45.813	CO	[g/km]	41.844
HC	[g/km]	5.535	HC	[g/km]	5.560	HC	[g/km]	6.389
N0x	[g/km]	1.508	N0x	[g/km]	1.695	N0x	[g/km]	2.137
HC+N0x	[g/km]	7.042	HC+N0x	[g/km]	7.255	HC+N0x	[g/km]	8.526
CO2	[g/km]	202.281	CO2	[g/km]	196.607	CO2	[g/km]	195.995
CO2	[g/100 km]	2.023	CO2	[g/100 km]	1.966	CO2	[g/100 km]	1.960
FC	[l/100 km]	12.428	FC	[l/100 km]	11.980	FC	[l/100 km]	11.769

Emission Comparison of Combine cycles



The Effect to Engine Performance



Power Maximum (Carburetor)

- BE0 = 58.1 HP
- BE 5 = 58.7 HP
- BE 10 = 59.1 HP

Power Maximum (EFI)

- BE 0 = 96.7 HP
- BE5 = 97.1 HP
- BE10 = 98.2

Emission for Diesel Vehicles

TOYOTA INNOVA DIESEL			
	b0	b5	b10
CO (g/km)	1.05	1.26	1.06
HC (g/km)	0.00	0.00	0.00
N0x (g/km)	0.95	1.04	1.10
CO2 (g/km)	266.12	274.51	268.90
FC (l/100 km)	9.88	10.19	9.97
PM (g/km)	0.13	0.13	0.13
HC+PM (g/km)	0.13	0.13	0.13

ISUZU PANTHER LS 25			
	b0	b5	b10
CO (g/km)	2.76	2.69	2.38
HC (g/km)	0.17	0.27	0.26
N0x (g/km)	3.48	4.17	4.30
CO2 (g/km)	280.45	282.67	283.33
FC (l/100 km)	10.53	10.61	10.87
PM (g/km)	0.53	0.38	0.37
HC+PM (g/km)	0.70	0.64	0.64

density (g/cu.cm)	0.8543	0.8552	0.8561
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Catatan
 PM = Particulate Matter
 FC = Fuel Consumption

Policy Development

- ❑ Driving the leaded gasoline phase out in the country
 - Recommendation from the national workshop
 - Recommendation during public exposed in Jakarta
- ❑ Monitoring data has been used to develop the AAQS in West Java
- ❑ Involve in the development of national EF for transportation sector

Current and Future Activities

- ❑ To Conduct Emission Inventory
- ❑ Bandung Clean Air Act (Gerakan Udara Bersih)
- ❑ Public Participation and Appreciation
- ❑ Institution based Emission Test
 - Shopping Mall
 - Government Institutions
 - Universities

Thank you

