Fuel Economy Initiative in Indonesia

Outline

- Background
  - Air pollution and health effect
  - Fuel quality and supply
- Fuel Economy baseline
- Cost Benefit Analysis
- Conclusion

Background

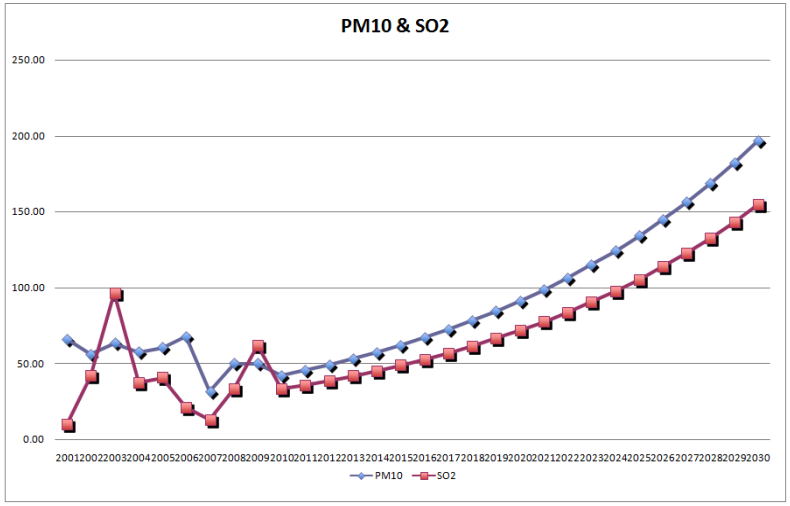
- Indonesia is the country in South East Asia with total population almost 240 million people (2010).
- Government burden on fuels subsidy:
  - National consumption of subsidized fuels is 38.4 million KL (2010) that cover Gasoline (23 million KL), Diesel Fuel (12.8 million KL), Kerosene (2.4 million KL), and Bio-fuels (.2 KL).
  - Fuel subsidy is ~ USD 70 billions (2010) and ~ USD 159 billions (2012).
- Land transportation shares around 12% of total national CO2 emission, and almost 90% urban air pollution (CO, HC, NOx, SOx, PM, O3).
- Challenges Free Trade ASEAN Economic Community – AEC (2015), ASEAN MRA (2012) and UNECA Regulation:
  - The competitiveness of domestic oil and auto-industry in the sub regional market of ASEAN.

Transportation and Emissions

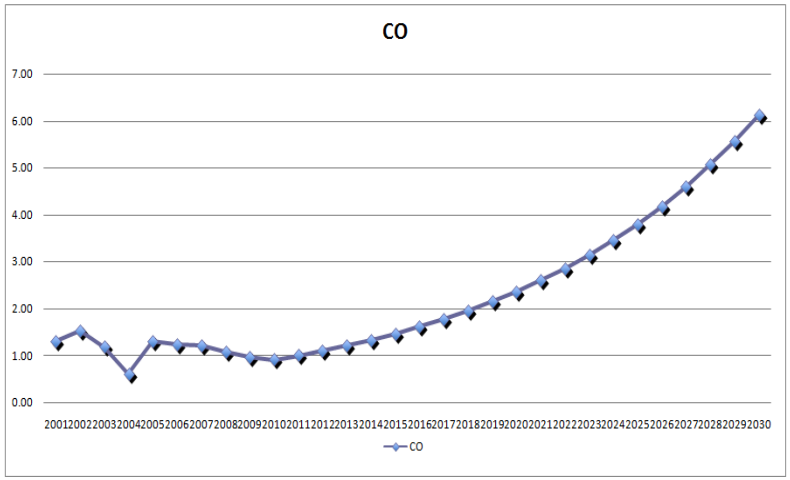

Photo: KPB

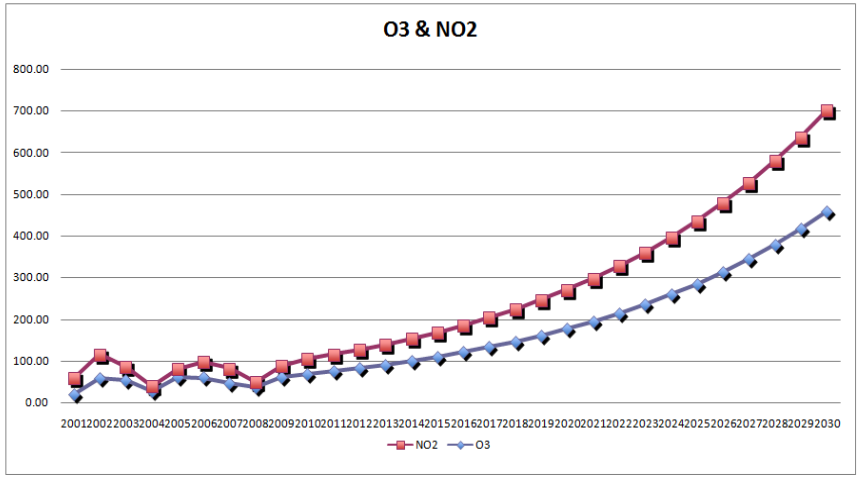
Air Pollution and Its Health Effect

Case: Jakarta - 2010

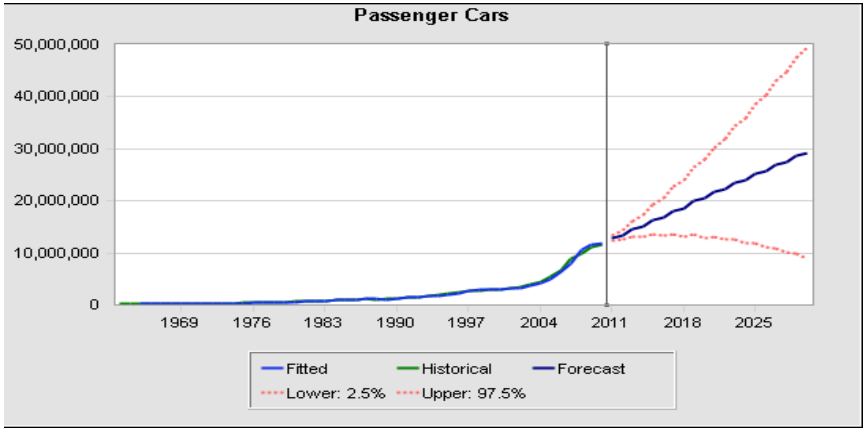


- Total population of Jakarta is 9,607,787
- 57.8% of the Jakarta population were suffered by various air pollution-related diseases :
  - 1,210,581 people suffered by asthmatic bronchiale (compared with 500,000 population founded by Ostro 1994);
  - 173,487 people with bronchopneumonia;
  - 2,449,986 with ARI;
  - 336,273 people with pneumonia;
  - 153,724 people with COPD, and;
  - 1,246,130 people with coronary artery diseases.
- Total direct health cost IDR 38.5 trillions ~ USD 41 billions

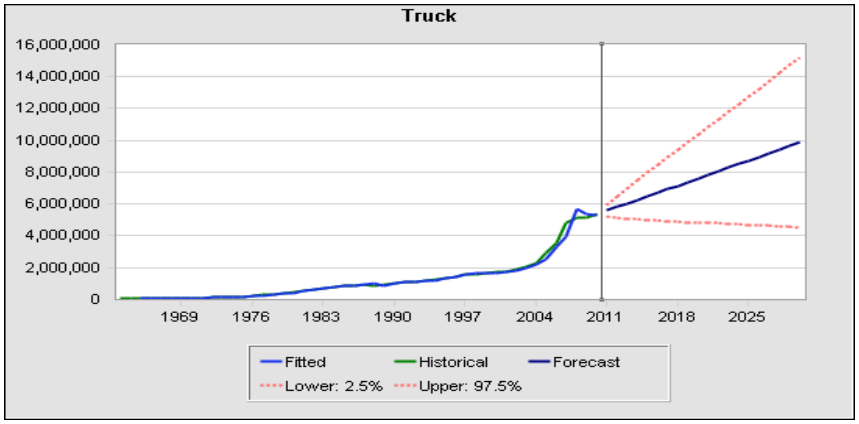




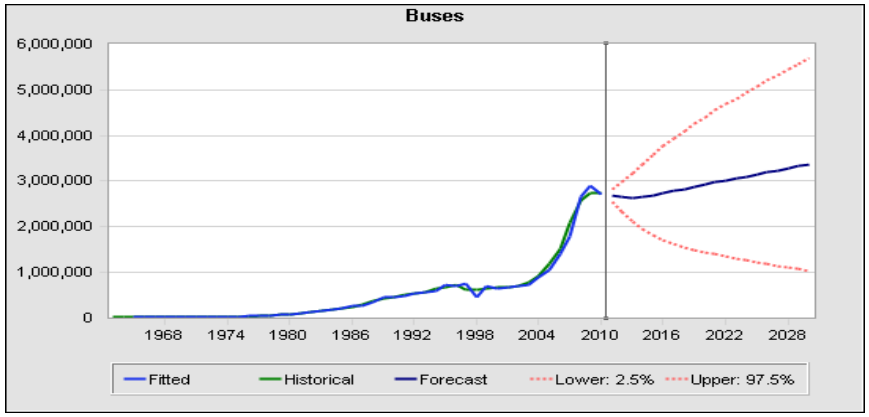
Forecasting of Vehicle number 2030



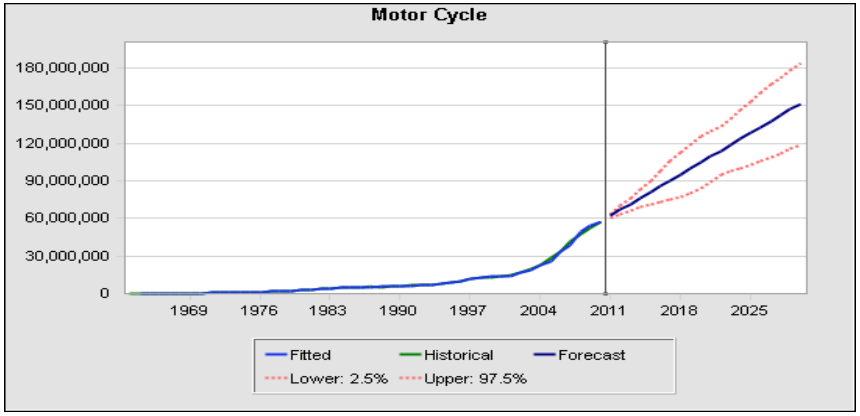
Best method : ARIMA(1,2,1)
Error measure (RMSE) : 232634.60



Best method : ARIMA(1,2,1)
Error measure (RMSE) : 176449.44



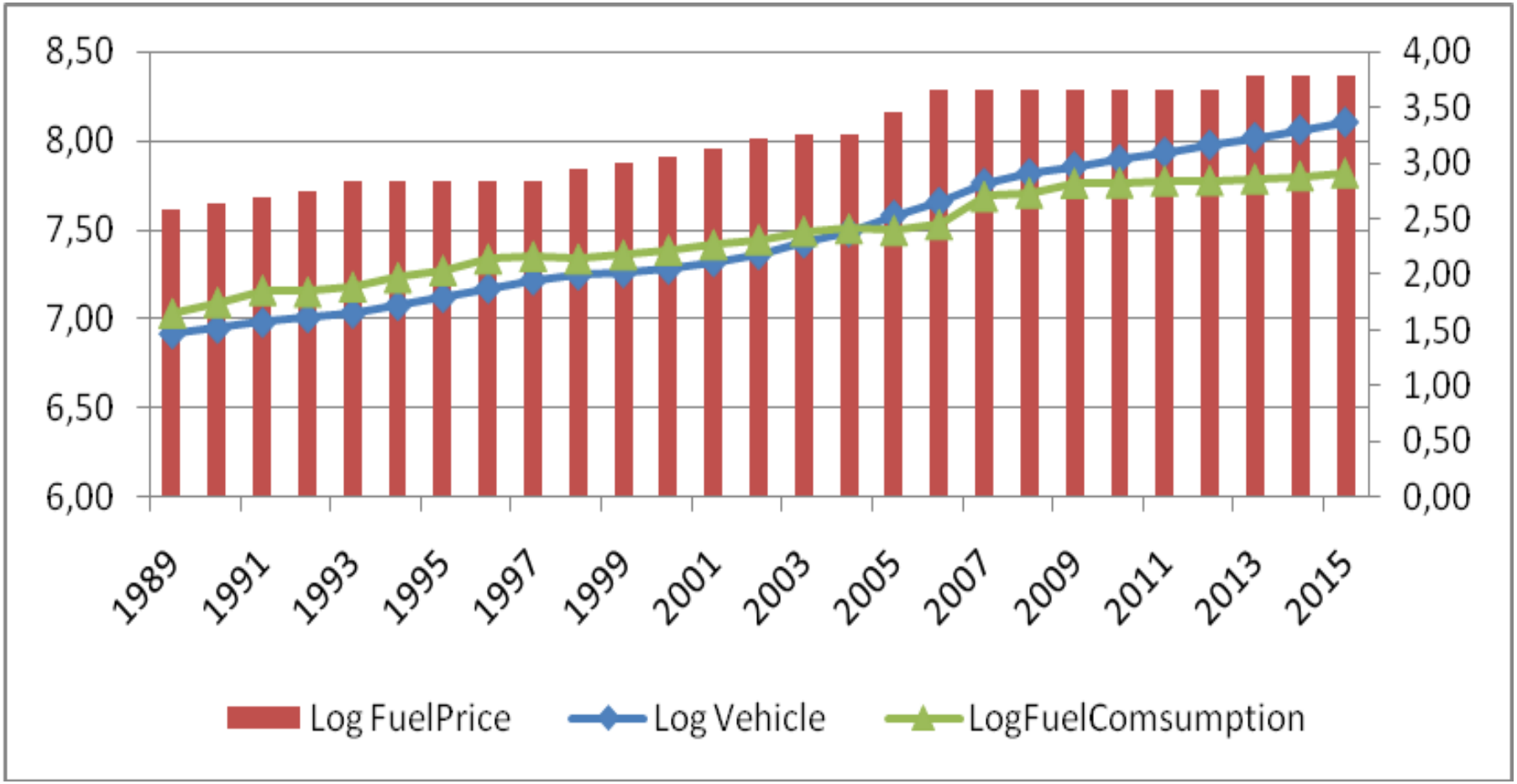
Best method : ARIMA(2,2,1)
Error measure (RMSE) : 69296.34



Best method : Double Exponential Smoothing
Error measure (RMSE) : 787400.81

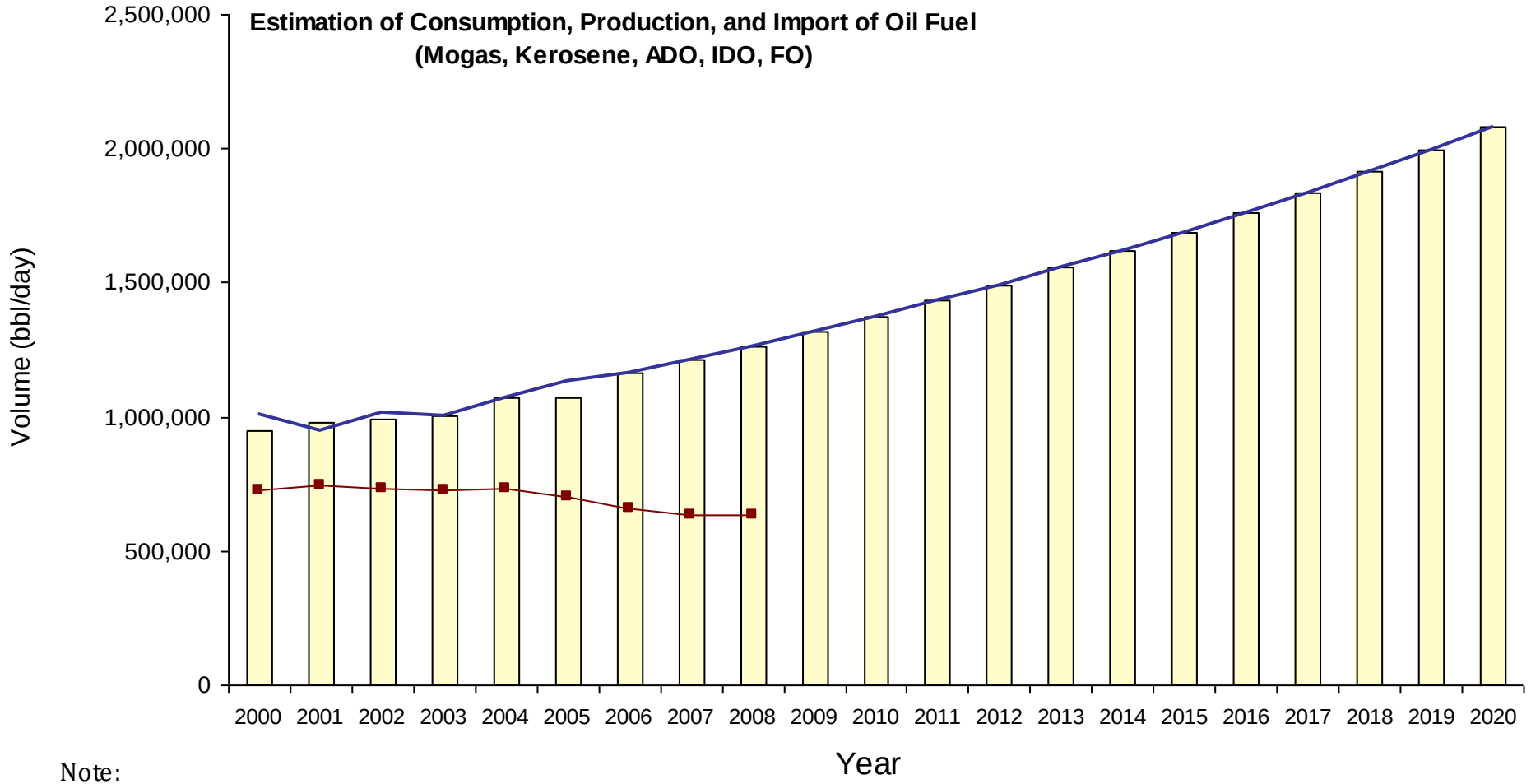
Source : Author estimation(2012)

Elasticity of Fuel Price and Vehicle Numbers on Fuel Consumption



Source : CIEC, Pertamina and Author Estimation

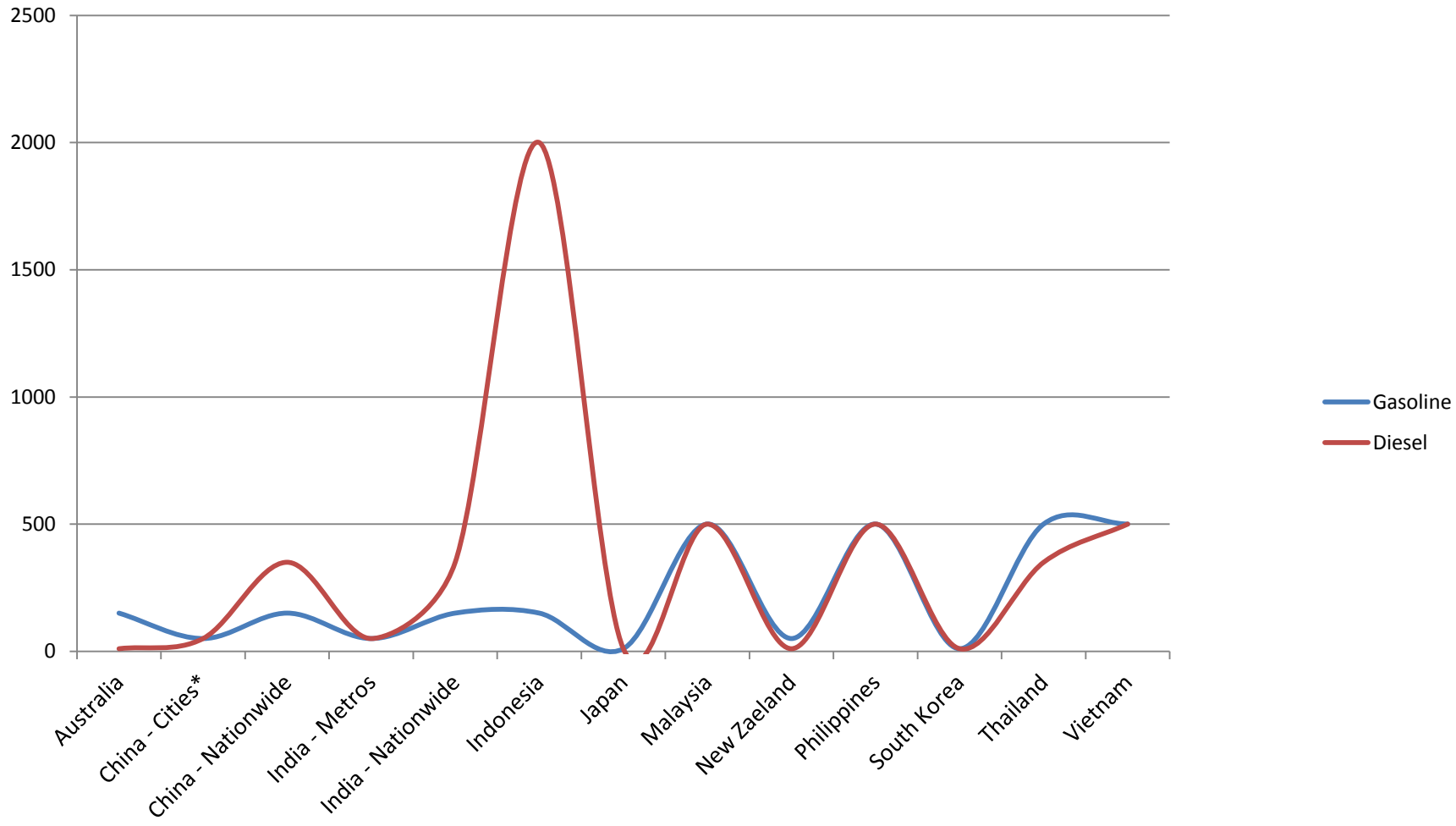
FUEL SUPPLY & DEMAND



Note:
- Fuel Supply = Domestic fuel production + Import
- Data on 2006-2020 import = Consumption - Production
- Fuel consumption growth (average) 1995-2005 is 4,6%
- Assuming average fuel consumption growth of 4,5% in 2006-2020

Sulfur Content at Diesel Fuel in Asia

ppm - 2010



Baseline Fuel Economy

ℓ/100 km

Fuel consumption by engine size

Engine size (cc)	Obs.	Descriptive statistic				
		Mean	Median	Minimum	Maximum	st.deviation
Below 1,000	6	6.95	6.93	5.97	8	0.66
1,000 up to 2,500	363	9.4	9.41	4.7	20.2	1.66
2,500 up to 3,500	274	11.18	11.2	6.03	44.23	2.47
3,500 up to 10,000	622	14.46	13.84	7.84	46	4.21
Above 10,000	4	31.95	39.95	3.92	44	19.06

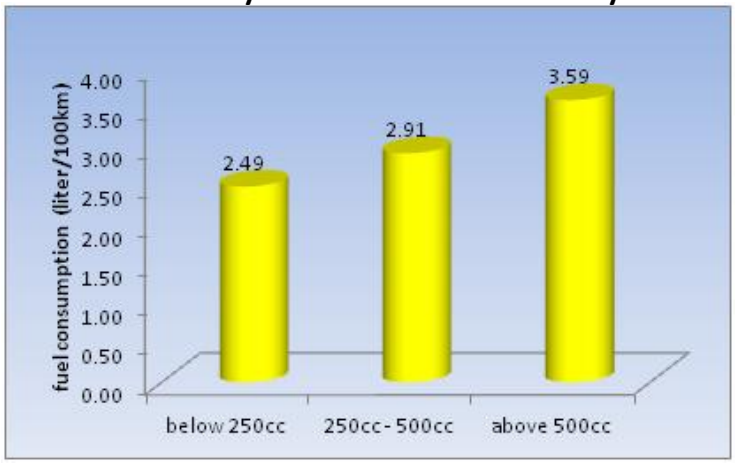
Fuel consumption by vehicle type

Type of vehicle	Descriptive statistic				
	Mean	Median	Minimum	Maximum	st.deviation
Passenger Car	12.5	11.76	3.9	46	4.3
Bus	11.8	11.76	6.5	19.6	3.0
Truck	12.2	11.2	4.7	44	4.3
Motorcycle	2.9	2.8	1.4	3.9	0.61

Fuel consumption by fuels type

Fuel type[1]	Descriptive statistic				
	Mean	Median	Minimum	Maximum	st.deviation
Gasoline	12.4	11.8	4.7	44.2	5.0
Diesel	12.3	11.8	3.9	46	3.7

Motorcycle's Fuel Economy



Vehicle Standard:

- Euro 3 Standard for Motor Cycle (August 2013)
- Euro 2 Standard for Car and Motor Cycle since 2007

CBA – Cost Benefit Analysis
Fuel Economy in Indonesia

Fuel Economy - Policies Formula

Policy Option	Title	Description	Parameter and Its Source
1	**Emission Standard**	Implement Euro 2 at 2005, Euro 3 at 2015, and Euro 4 at 2020	Table Appendix 3. Adopted Emission Factors (g/km) at 80,000 km, source : Coffe (2005)
2	**Fuel Efficiency +Option 1**	Enhance fuel Efficiency 10 % by 2009	
3	**CNG +Option 1**	Convert to Gas for Passenger Cars and Bus, at least 1 % at 2009, 2 % at 2011, and at 5 % at 2021	Assume Cost for Gas Coverter = $800 , Gas Fuel CO NO HC PM Reduction 0.89 0.53 0 0.85 Sources Evaluating the Emission Reduction Benefits of WMATA Natural Gas Buses, www.eere.energy.gov
4	**Catalytic Coverter+Option 1**	Use Catalytic Converter to Diesel vehicles (25 % of Passenger Car, Bus, and Truck)	Cost for Catalyc Coverter = $800 , Gas Fuel CO NO HC PM Reduction 0.0 0.15 0 0.5 Sources: Michael P.Walsh (May,2006)
5	**Hybrid Technology + Option 1**	Use Hybrid technology for Passenger cars and Bus, at least 0.05% at 2009, 0.1 % at 2011,0.5 % at 2016, and 1 % at 2021	Cost for Catalyc Coverter = $10,000 Assume fuel efficiency increases about 4.1 times than non hybrid technology.
6	**Scapped + Option 1**	Scrapped the 50 % vehicles that more than 20 years old from 2009	
7	**Biofuel + Option 1**	Convert to Biofuel for Passenger Cars and Bus, at least 1 % at 2009, 2 % at 2011, and at 5 % at 2021	Cost for processing biofuel = IDR 4,584/Liter is taken from Hadi et.al,(2010),http://psp3.ipb.ac.id/jurnal/index.php/artikel/article/view/23 Gas Fuel CO NO HC PM Reduction 0.47 -0.22 0.46 0.55 Sources: Xue, J., Tony, E.G and Alan C.H (2011)
8	**Public Transport + Option 1**	Result passenger car and motor cycle shift to public transport at least 5% and 1% at 2011, 10% and 5 % at 2014, 20% and 10% at 2018 and 40% and 20% at 2025	Invest on bus rapid transit and busway (2005-2015), commuter line (2010-2020), and MRT (2015-2025). Cost for Investment is provided in table 9. We have limitation to consider operating and maintanance cost as well as expected reveneue from tariff.
9	**Leapfrog Emission Standard + Option 1**	Implement Euro 2 at 2005, Euro 3 at 2013, and Euro 4 at 2016	Implement Euro 2 at 2005, Euro 3 at 2013, and Euro 4 at 2016

Cost and Benefit Analysis

(2005-2030)

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9
Cost									
Refinery Production	467,416	428,932	431,091	467,416	338,794	464,669	458,053	421,638	466,745
Technology Utilization	493,312	664,566	15,863	643,108	784,586	30,911	342,032	117,541	493,312
Total Cost	960,728	1,093,497	446,954	1,110,523	1,123,380	495,580	800,086	539,179	960,057
Benefit									
Health Improvement	1,656,264	2,646,587	1,532,923	2,012,137	2,854,542	1,667,728	1,667,729	1,649,883	1,648,305
Production Saving	27,712	157,826	52,277	27,712	448,393	36,237	57,138	169,923	31,387
Subsidy Saving	286,392	1,640,422	539,615	286,392	4,601,071	373,975	589,473	1,746,763	324,084
Total Benefit	1,970,368	4,444,835	2,124,816	2,326,241	7,904,005	2,077,940	2,314,340	3,566,569	2,003,776
FY 2005-2030									
Net Benefit	1,009,640	3,351,338	1,677,862	1,215,717	6,780,625	1,582,360	1,514,255	3,027,390	1,043,719
NPV; SDR 8 %	38,963	803,680	310,516	374,486	1,563,678	290,778	275,887	599,926	47,736
Net Benefit Average	38,832	128,898	64,533	46,758	260,793	60,860	58,241	116,438	40,143
FY 2009-2030									
Fuel Saving	286,392	1,640,422	539,615	286,392	4,601,071	373,975	589,473	1,746,763	324,084
NPV; SDR 8 %	71,395	469,465	127,900	71,395	1,098,827	91,202	144,873	388,089	84,727
Net Benefit Average	13,018	74,565	24,528	13,018	209,140	16,999	26,794	79,398	14,731

Cost of Effectiveness

(2005-2030)

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9
Cost (IDR Billion)	960,728	1,093,497	446,954	1,110,523	1,123,380	495,580	800,086	539,179	960,057
Emission Reduction (Million ton)									
CO	9,142	12,869	9,231	9,142	13,565	9,156	9,190	12,488	11,519
NOx	6,269	11,548	6,524	7,596	13,621	6,327	6,204	6,799	7,903
HC	2,178	3,057	2,178	3,244	3,244	2,438	2,196	2,697	2,741
PM	663	768	671	776	776	664	668	684	858
Cost Effectiveness (IDR Billion per million ton)									
CO	105	85	48	121	83	54	87	43	83
Nox	153	95	69	146	82	78	129	79	121
HC	441	358	205	342	346	203	364	200	350
PM	1,449	1,424	667	1,431	1,447	746	1,198	788	1,120

CBA Fuel Economy Resume

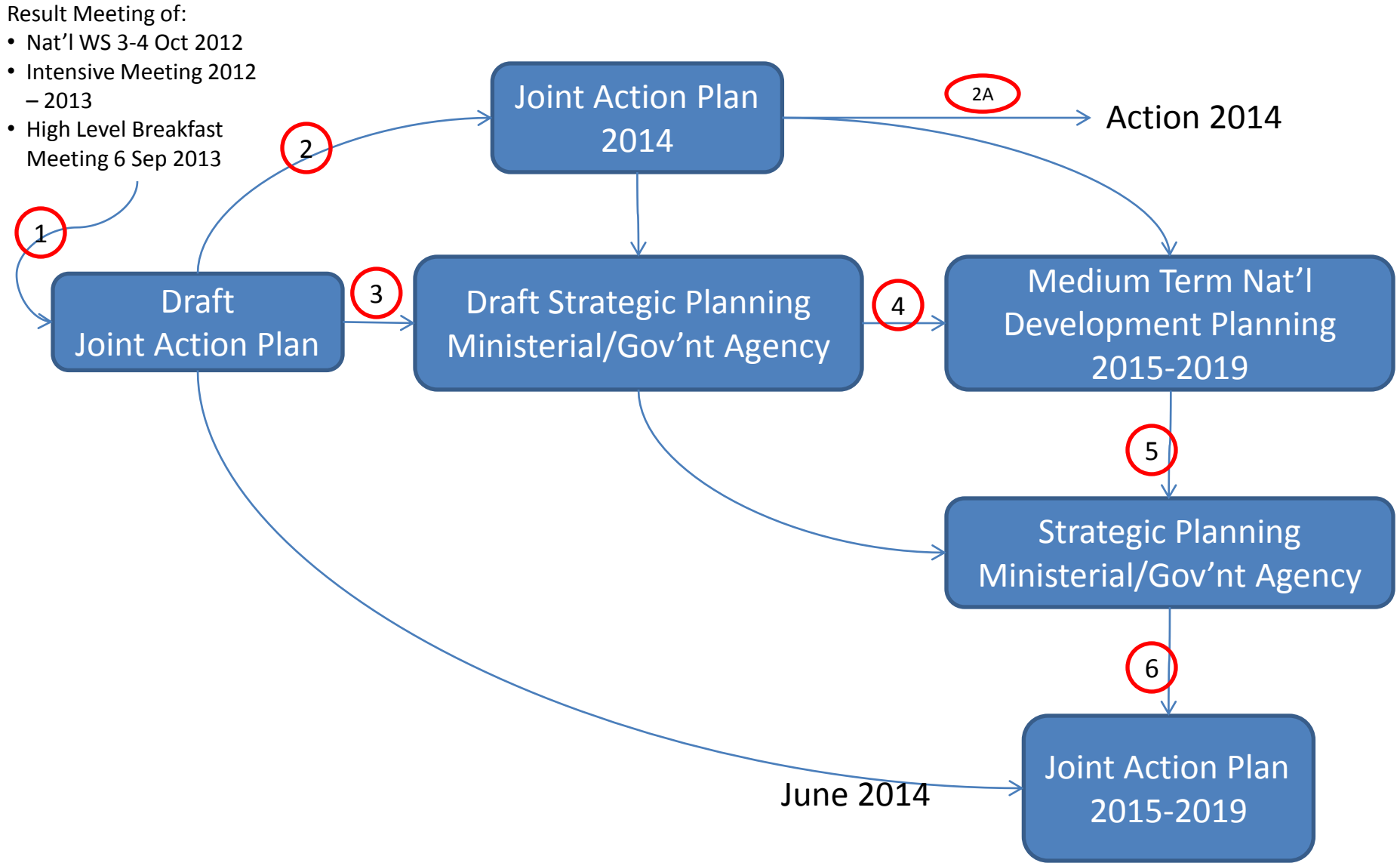
- Both result of Cost Benefit Analysis and Cost-effectiveness show that Improving ***Public Transportation*** is the best option on provide high economic benefit (*economic gain* and *fuel saving*) and lowest cost of emissions reduction per million ton.
- ***Scrapping*** old vehicles provides the highest economic benefit (*economic gain* dan *fuel saving*), then are followed by ***Fuels Efficiency***, and ***Improving Public Transportation***.
- Base on 9 options policy, its show that lowest cost of emissions reduction per million ton is ***Improving Public Transportation*** then followed by ***CNG Vehicle*** and ***Hybrid Car***.
- ***Vehicle Emission Standard*** program would be have another benefit, beside its *economic gain* and *fuel saving*:
  - Improving automotive industry competitiveness in sub-regional market of ASEAN.

Vehicle Emission Standard

Pre-conditioning to Fuel Economy (1)

- Intensive Dialog on Roadmap Fuel Economy – Vehicle Emission Standard – Euro 4:
  - High level meeting (6 September 2013)
  - Workshop (17 September 2013)
  - Consultative meetings in the range on September – December 2013
  - Assessment visit "preparedness of domestic refineries to adopt low sulfur fuel for Euro 4 Standard by 2016 gradually":
    - Balongan Refinery
    - Balikpapan Refinery
- Win-win solution "The Roadmap Vehicle Emission Standard – Euro 4 by 2016 Gradually":
  - Current issue: the fact capacity of domestic refinery
    - To modify refinery (Balongan dan Balikpapan).
    - Seeking the investment for refinery modification.
  - Start to supply the big cities in Indonesia (2016), while waiting the national wide agenda – construct new refinery to produce low sulfur fuel for Euro 4 Standard Vehicle (2021)
  - November 2013 – June 2014 is critical time to get the funding to invest on refinery modification.
  - July 2014 – June 2016 is the construction refinery modification and or other technical option.

Fuel Economy Policy Formulation in the National Development Planning



Thank you