



Integrated Environmental Strategies – Philippines

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the US Agency for International Development,
US Environmental Protection Agency and
US National Renewable Energy Laboratory*

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DENR-EMB



What is Integrated Environmental Strategies?

- An approach to support and promote the analysis of public health and environmental benefits of integrated strategies for greenhouse gas mitigation and local environmental improvement e.g. local air pollution reduction



Integrated Environmental Strategies – Philippines

Manila Observatory – USAID, US EPA, NREL

The Study Area covers Metro Manila and adjacent towns/cities of Bulacan, Rizal, Cavite and Laguna

98 zones:

Zones 1-94: Metro Manila

Zones 95-98: 4 adjacent provinces





Scenarios and Assumptions

■ **Business-As-Usual (BAU)**

■ 2005 & 2010

- Road network: 1^o and 2^o roads, Expressways (NLEX, SLEX, Mla-Cav), Skyway (Mkti-Bicutan)
- Rail System: LRT1, MRT3, LRT2

■ 2015 – MMUTIS Master Plan

■ **Motor Vehicle Inspection System (MVIS)**

■ 2005

- 25% cars, 100% jeepneys, 30% buses & 30% trucks meet emission standards (60% less SPM)

■ 2010

- 25% cars, 100% jeepneys, 100% buses & 40% trucks meet SPM emission stds and all vehicles meet I/M std (30% less SPM)

■ 2015

- 50% cars, 100% jeepneys, 30% buses & 30% trucks meet emission and all vehicles meet I/M standards
- All buses running on CNG



Scenarios and Assumptions

- **Traffic Demand Management (TDM)**
 - 9% of car users affected by Use Public Transport and 10% by Share A Ride schemes
 - All vehicles meeting I/M standards (30% less SPM)
- **Replacement of 2-stroke with 4-stroke Tricycles**
 - SPM EF of 4-stroke TCS only 20% of 2-stroke TCs
 - Total replacement assumed for 2005 and 2010; only traffic demand varies
- **Construction of Bikeways**
 - Marikina: 1.5% reduction in tricycle vehicle-kms for 2005 and 3.5% for 2010
 - Metro Manila: same reduction rates applied to all 98 zones



Scenarios and Assumptions

- **Railway Expansion by 2015**
 - 164.1 km of new MRT/LRT lines and 19.7 km busways
- **Diesel Particulate Trap for Buses and Jeepneys**
 - PM emission reduced by 30%
 - Applied to all diesel buses
- **Catalytic Converters for Diesel Cars**
 - PM emission reduced by 35%
 - 100% of diesel car fleet by 2015
- **Importation Ban on 2nd-hand Engines for Diesel Trucks (2HE)**
 - PM emission reduced by 30%
 - .20% of diesel fleet as of 2005



Scenarios and Assumptions

- **Compressed Natural Gas for Buses (CNG)**
 - SPM reduced by 86 % and CO2 by 45%
 - 2005 – C-5, EDSA, SLEX
 - Low case: 90 buses = .88% of diesel bus fleet
 - High case: 180 buses = 1.76%
 - 2010 – C-5, EDSA, SLEX, NLEX
 - Low case: 1,500 buses = 11.5% of diesel bus fleet
 - High case: 3,000 buses = 1.76%

- **Coco-methyl ester (CME) - diesel blend for Jeepneys**
 - SPM reduced by 40% and CO2 by 78%
 - Emission reduction applied to all zones
 - 2005 - Low case: 2,500 buses = .64% of jeepneys
High case: 5,000 buses = 1.27%
 - 2010 - Low case: 1,500 buses = 11.5% of jeepneys
High case: 3,000 buses = 1.76%



Summary of Scenarios

			2005		2010		2015	
Policy Measures		Code	SPM	CO2	SPM	CO2	SPM	CO2
1	Business-as Usual	BAU	x	x	x	x	x	x
2	Motor Vehicle Inspection System*	MVIS	x	x	x	x	x	x
3	CNG Bus Low	CNGBL	x	x	x	x		
4	CNG Bus High	CNGBH	x	x	x	x		
5	CME Jeep Low	CMEJL	x	x	x	x		
6	CME Jeep High	CMEJH	x	x	x	x		
7	Traffic Demand Management	TDM	x	x				
8	2-stroke to 4-stroke tricycles	4STC	x		x			
9	Bikeways Marikina	BWMK	x	x			x	x
10	Bikeways Metro Manila	BWMM	x	x			x	x
11	Bus Particulate Trap	BPT	x					
12	Bus Jeep Particulate Trap	BJPT	x					
13	2nd-hand engine ban for trucks	2HEBAN	x					
14	Railway expansion	RWAY					x	x
15	Catalytic Converter	CATCON					x	
16	Combination of Measures	COMBI	x	x	x	x	x	x

* w/100% CNG buses for 2015

HEALTH IMPACTS OF POLICY SCENARIOS



Health Impact Assessment

How many deaths/cases will be averted by each policy scenario?

- Natural Mortality
- Respiratory Mortality
- Cardiovascular Mortality
- Respiratory Hospital Admissions
- Cardiovascular Hospital Admissions
- Asthma Attacks <15 years old
- Asthma Attacks =/> 15 years old
- Bronchitis Episodes < 15 years old
- Chronic Bronchitis > 25 years old



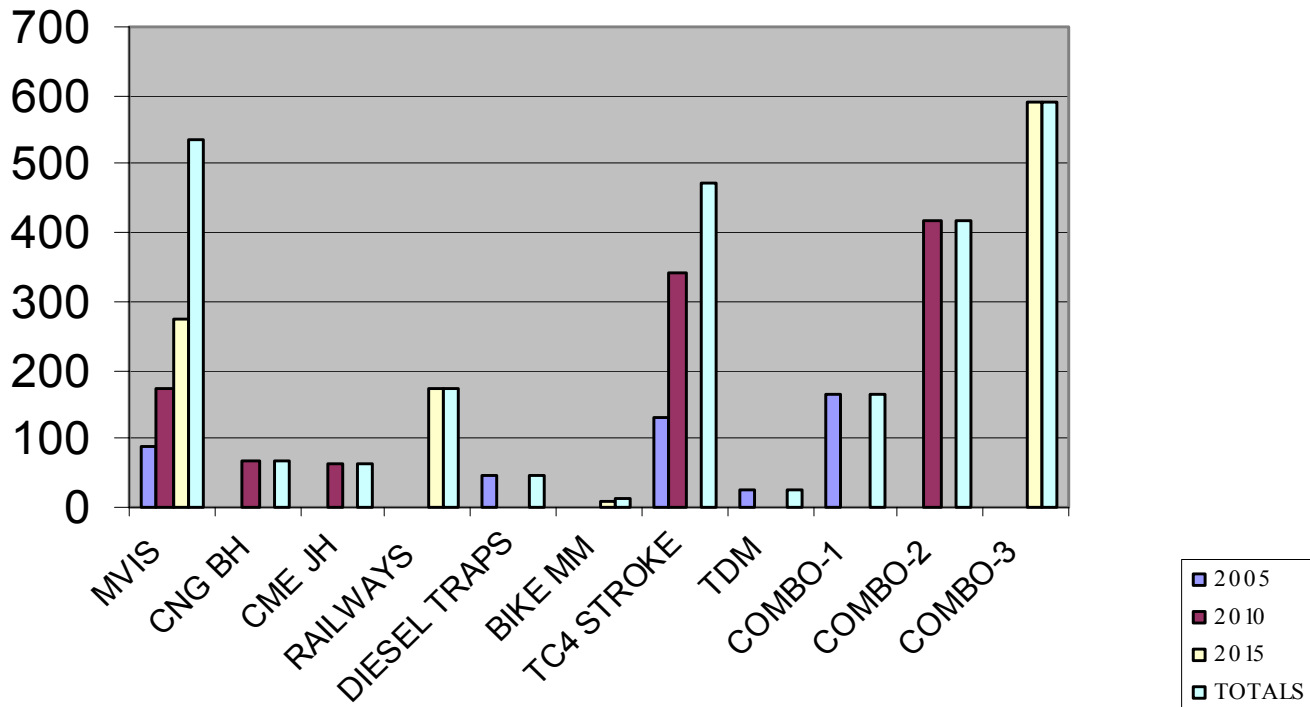
Policy Scenarios

- Motor Vehicle Inspection System (2005, 2010,2015)
- Conversion to 4-stroke tricycles(2005,2010)
- Railways(2015)
- Diesel Particulate Trap(2005)
- Compressed Natural Gas – Buses(2005,2010)
- CocoMethyl Ester – Jeepneys(2005,2010)
- Traffic Demand Management(2005)
- Bikeways(2005)
- Combo-1: MVIS+TDM+CNG+CME+DPT+Bikeways(2005)
- Combo-2:
MVIS+TDM+CNG+CME+DPT+Bikeways+TC4stroke(2010)
- Combo-3:
MVIS+TDM+CNG+CME+DPT+Bikeways+TC4stroke+Railways
(2015)



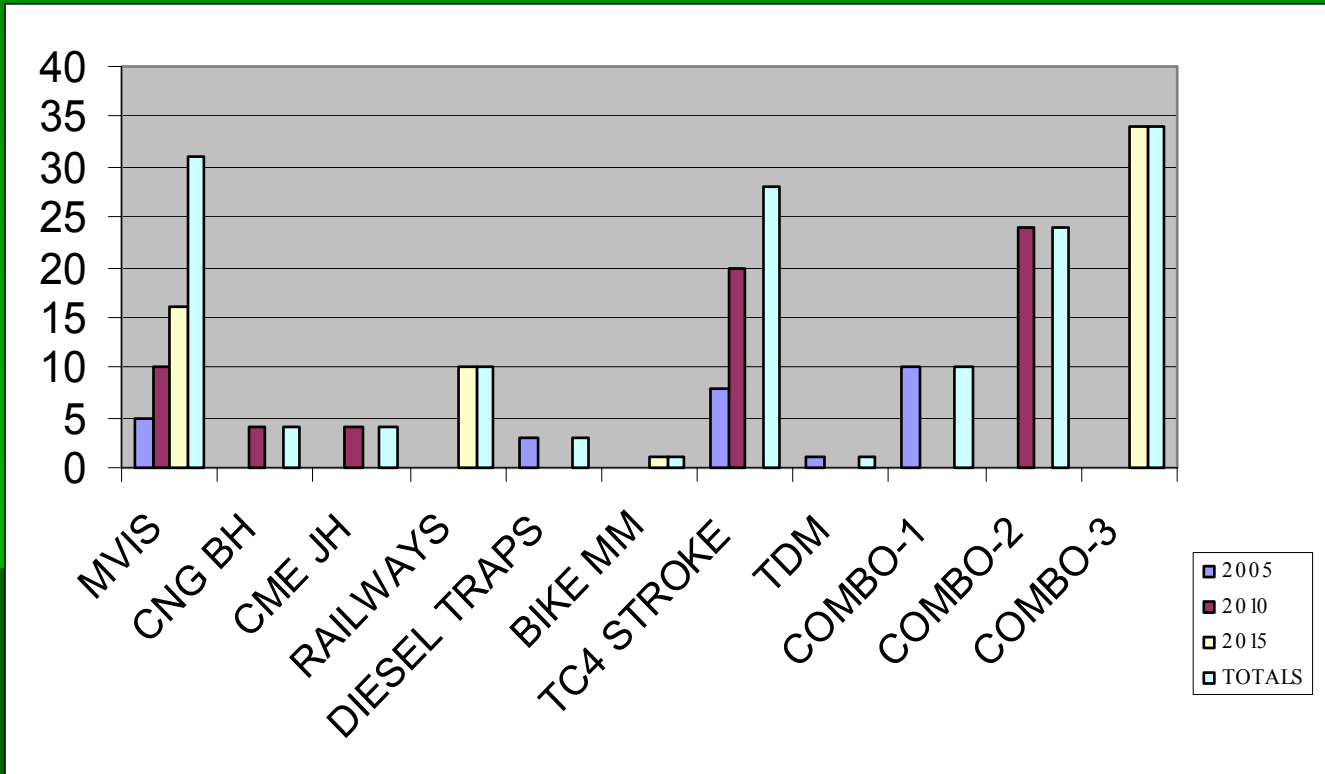
MORTALITY: Metro Manila

Number of Deaths Averted per Policy scenario



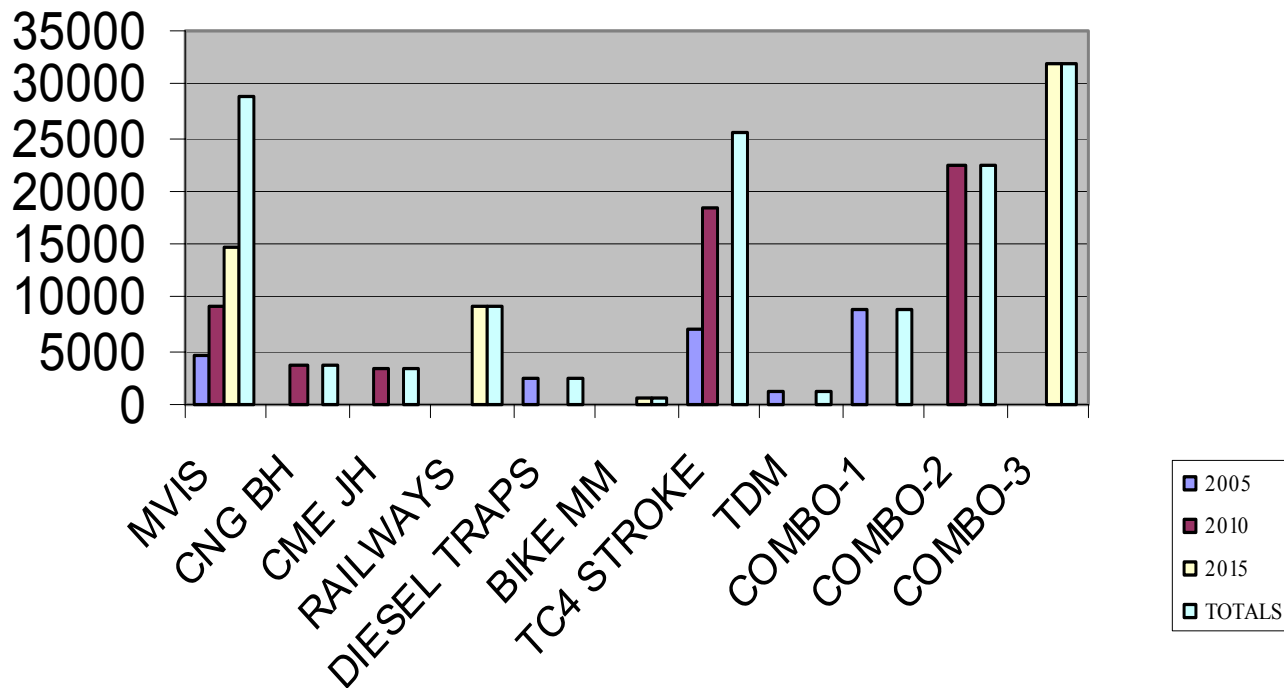
Cardiovascular Hospital Admissions: Metro Manila

Number of Cases Averted per Policy Scenario



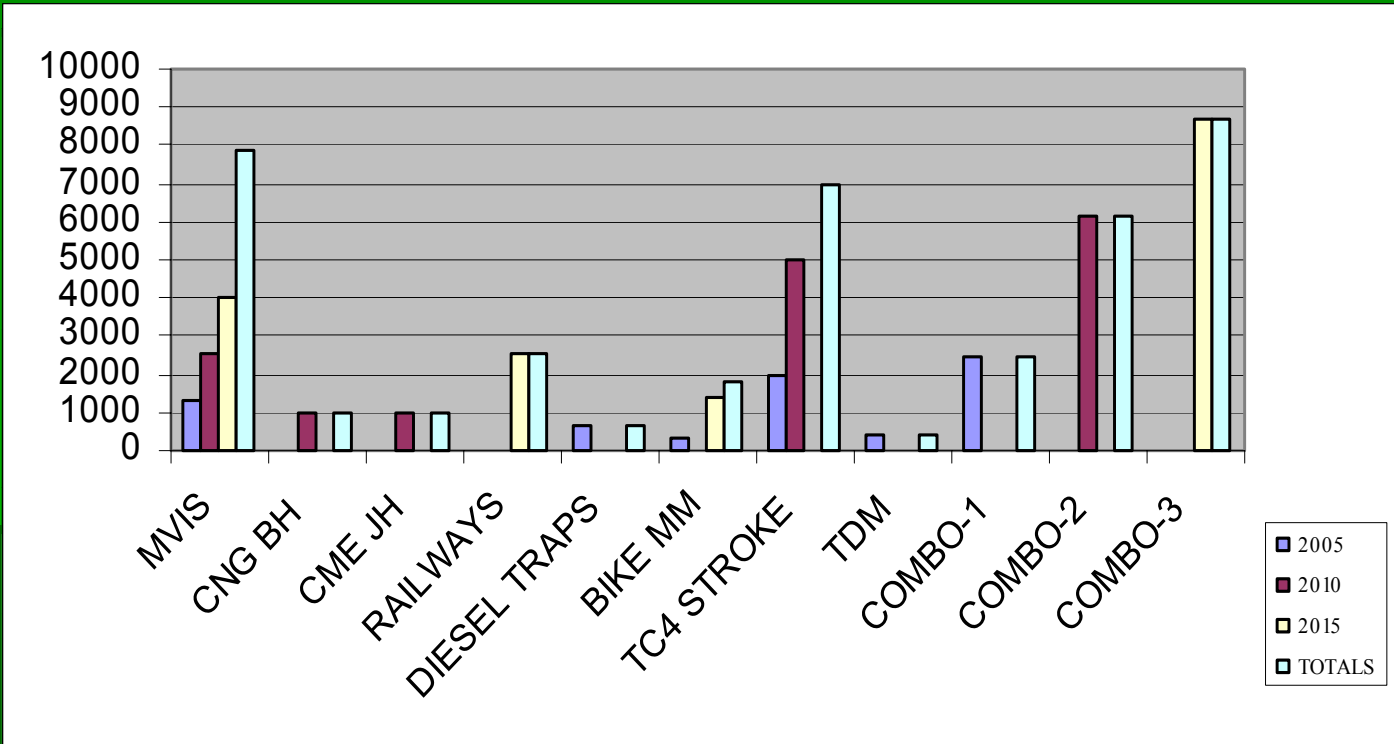
Asthma Attacks <15 years old: Metro Manila

Number of Cases per Policy Scenario



Chronic Bronchitis >25 years old: Metro Manila

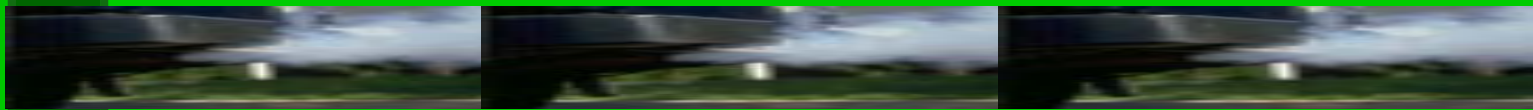
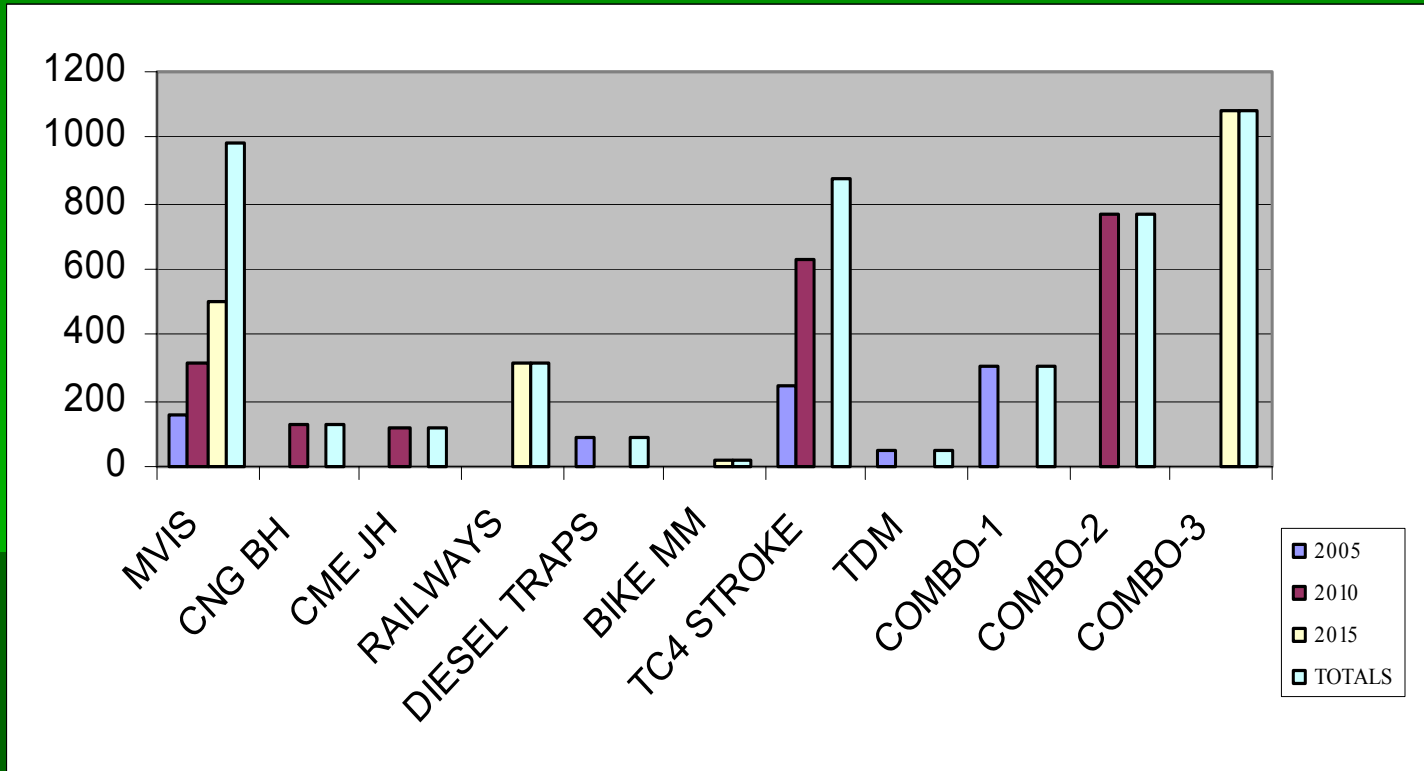
Number of Cases Averted per Policy Scenario



Bronchitis Episodes

<15 years old: Metro Manila

Number of Cases Averted per Policy Scenario



ECONOMIC VALUATION OF THE HEALTH IMPACT OF AIR POLLUTION PER POLICY SCENARIO



What is the cost of the health damages that can be averted by the different policy scenarios?

- Morbidity:

Cost of illness method
Work Loss Days

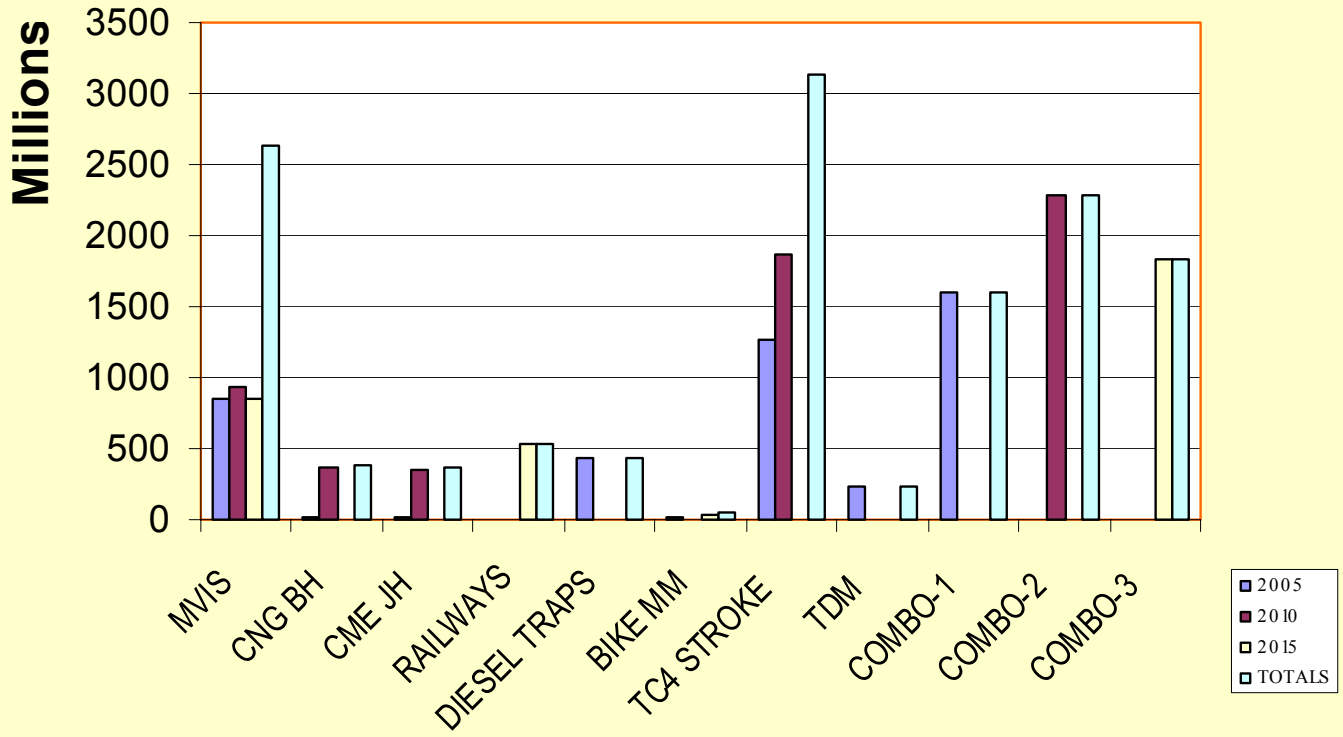
- Mortality:

Benefits Transfer

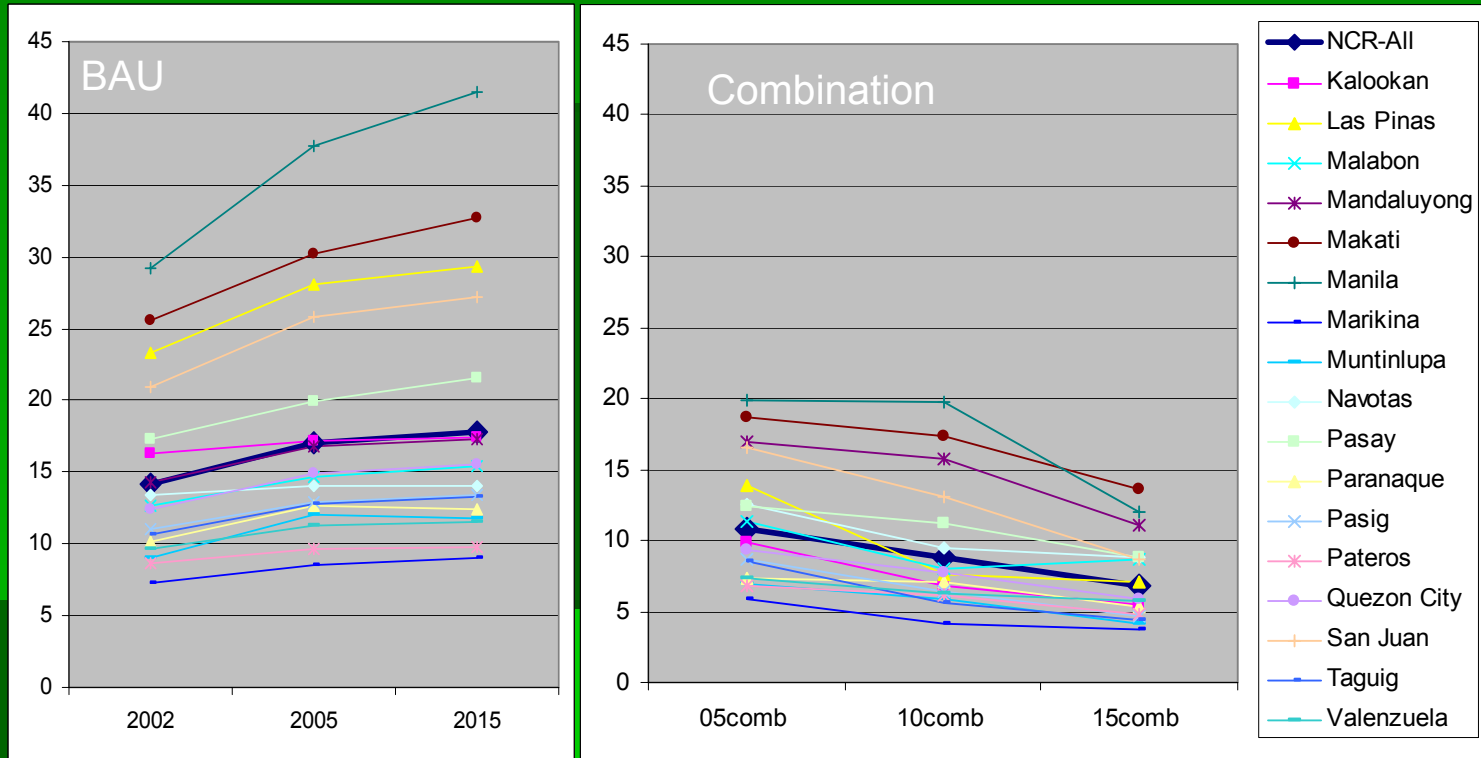
- Values are in 1995 prices
- Present Value of Year 2002 Estimates
- Using 12% discount rate for 2005, 2010,2015
- Orbeta Study and PhilHealth data



Economic Valuation of the Health Impact per Policy Scenario (PHP)

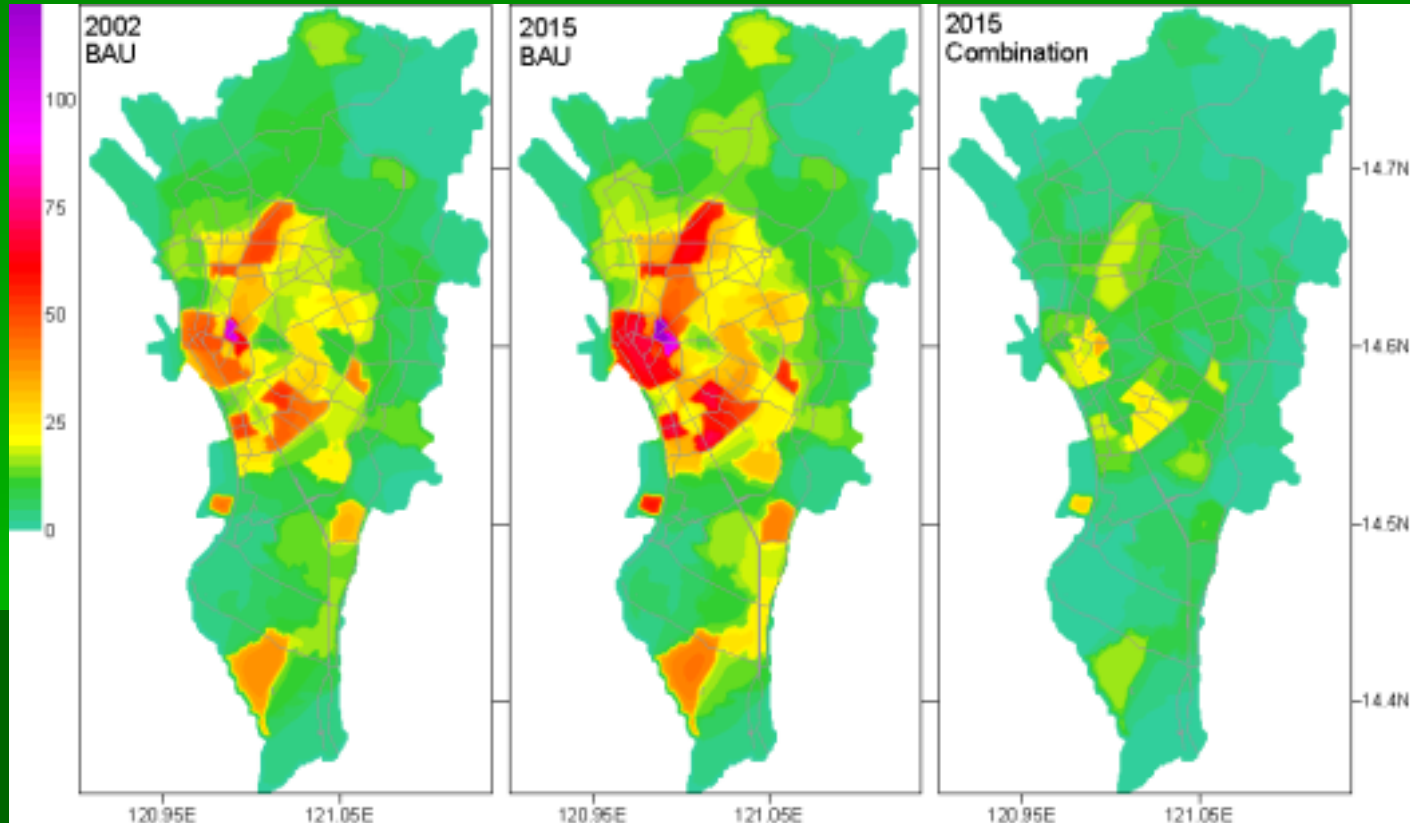


Best Scenario: Combination of Options



- Implementing a combination of policies can reduce PM₁₀ levels in Metro Manila by **half**

Future Air Quality in Metro Manila: Worst and Best Scenarios



- Worst: **Exceedances** widen, intensify
- Best: Peak levels less than *60 % of annual standard*



Thank You Very Much

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