S20 High Level Policy Webinar

APPLYING SCIENCE AND TECHNOLOGY
FOR CLEAN AIR AND CLIMATE CO-BENEFITS

How to be Consistent on Science Based Policy for Clean Air and Climate Co-benefits in Indonesia?

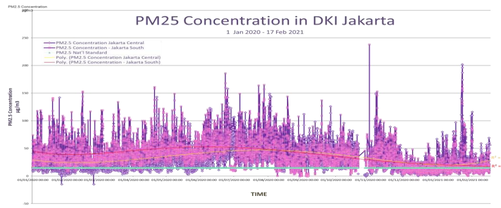
Case study: **CBA Low Emission Vehicle and Low Carbon Emission Vehicle**

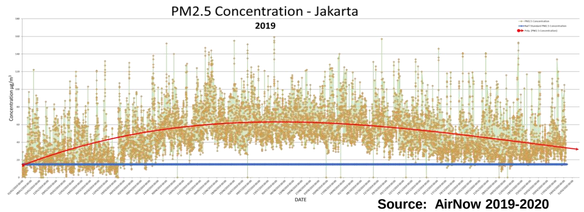
Ahmad Safrudin - KPBB

Session: Public Private Partnership and Stakeholder Engagement

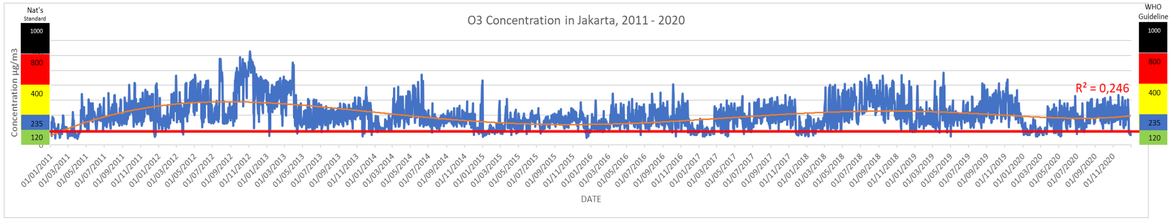
30 June 2022

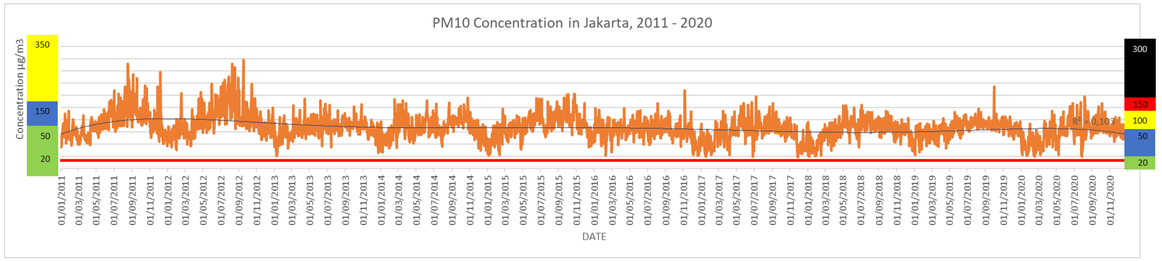
Jakarta's Air Quality Status 2011 - 2020

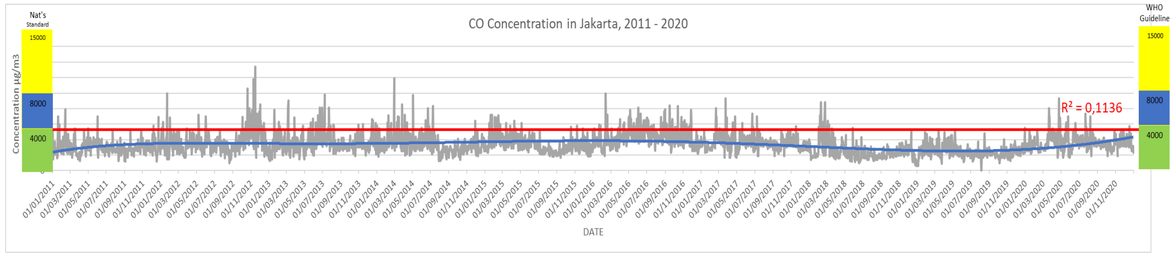


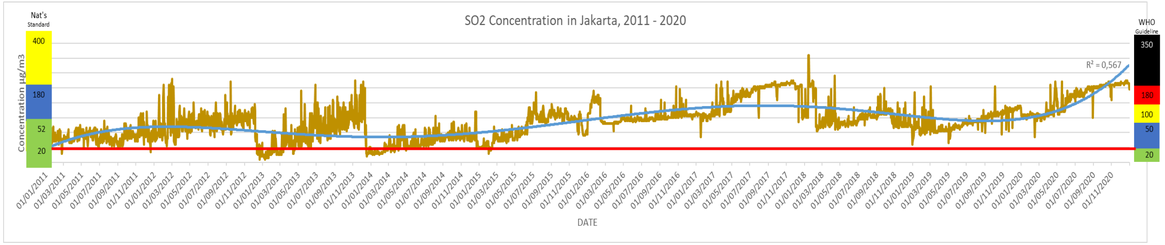


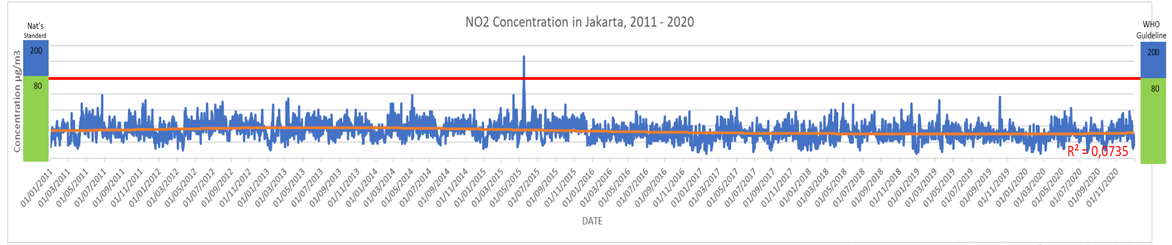
Source: AirNow 2019-2020



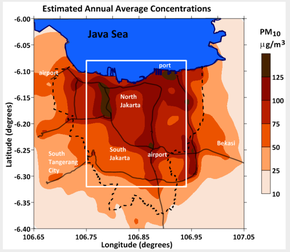




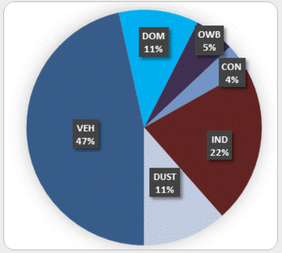




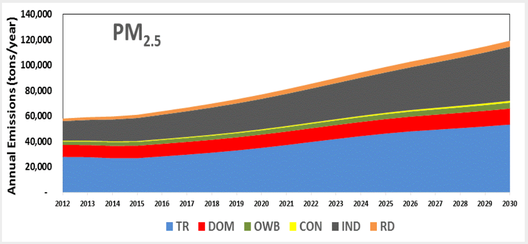
Source: AAQMS, DLH DKI Jakarta, 2011-2020



Dispersion Model Jakarta's Air Pollutants



Source of Apportionment Jakarta's Air Pollutants



Estimation of Emission Trend in Jakarta 2030

Source: Breathe Easy Jakarta, US-EPA, 2017

Health Effects of Air Pollution in Jakarta

2010 Case	2016 Case	DIESES/ILLNESS
1,210,581	1,489,014	Astma
173,487	214,256	Broncho-pneumonia
153,724	172,632	COPD
2,449,986	2,731,734	ARI/ISPA
336,273	373,935	Pneumonia
1,246,130	1,386,319	Coronary artery dieses

Source: Fuel Quality, Fuel Economy Initiative in Indonesia, US-EPA/UNEP, 2012; Up dated Study on Health Effect of Air Pollution, KPBB, 2016.

- In the 2011 – 2020 decade, Jakarta's air quality was in the unhealthy category with dominant parameters PM10, PM2.5, O3, SOx. The annual mean concentrations of PM2.5, PM10, O3 and SO2 (2020) were 46.1 g/m3, 59.03 g/m3, 83.3 g/m3 and 42.76 g/m3 respectively.
- Meanwhile, the concentrations of NO2 and CO (average 8 hours) were 14.92 g/m3 and 3610 g/m3, respectively (2020).
- Base on source of apportionment air pollutants study shows that transportation is the most polluters for Jakarta.
- Health Effects: respiratory illness/dieses, nasopharynx cancer, coronary artery dieses, etc with medical cost IDR 38.5 T (2010) and IDR 51.2 T (2016)

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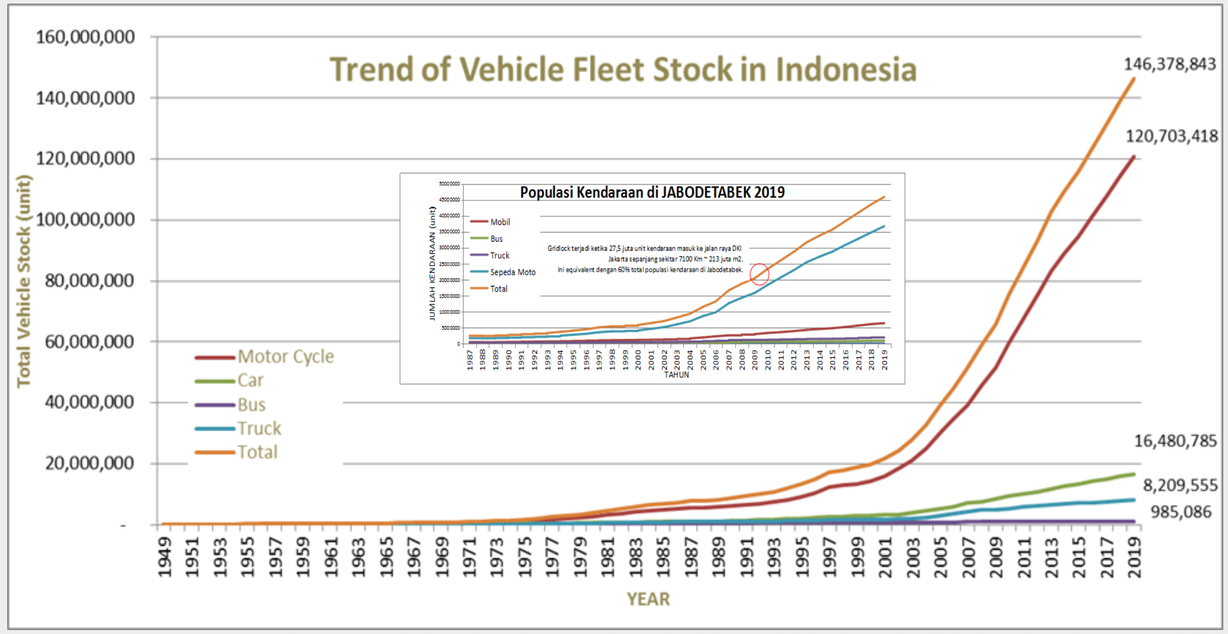
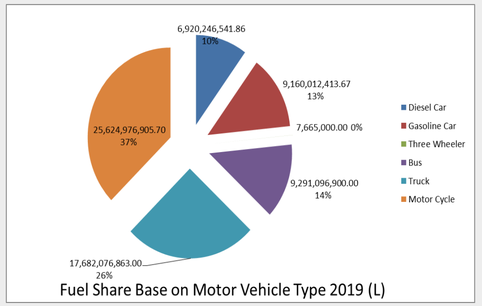
Vehicle Fleet Statistic



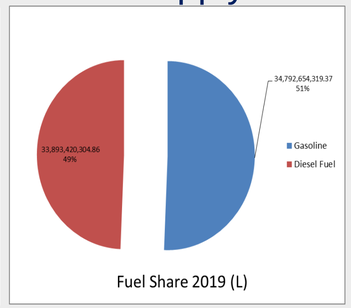
Source: BPS, SAMSAT, GAIKINDO, AISI, 2019; Vehicle Fleets Statistic in Indonesia, UNEP, 2020

Total sales (2019): 1,02 million units car and 6.48 million units motor cycle p.a.

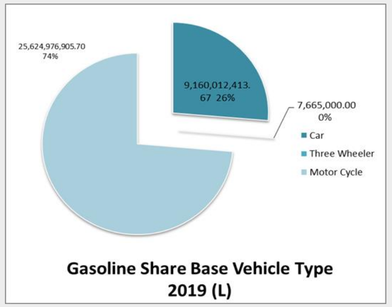
National Fuel Supply Burden



Fuel Share Base on Motor Vehicle Type 2019 (L)



Fuel Share 2019 (L)



Gasoline Share Base Vehicle Type 2019 (L)

Source: Vehicle Emission Standard in Indonesia, UNEP, 2020

Vehicular Fuel Consumption in Indonesia 2019 (L)

Fuel Consumption	Per Annum	Percentage
Diesel Car	6,920,246,541.86	10.08%
Gasoline Car	9,160,012,413.67	13.34%
3-Wheelers	7,665,000.00	0.01%
Bus	9,291,096,900.00	13.53%
Truck	17,682,076,863.00	25.74%
Motor Cycle	25,624,976,905.70	37.31%
Total	68,686,074,624.23	

Jenis BBM	Total Demand KL	Prosentase
Premium88	16,146,642,866	23.51%
Pertalite90	16,693,758,624	24.30%
Pertamax	12,470,002,068	18.16%
Pertamax Turbo	230,470,008	0.34%
Solar48	22,376,490,533	32.58%
Dexlite51	468,097,470	0.68%
Perta-DEX	300,613,054	0.44%
Perta-DEX HQ	-	0.00%
JUMLAH	68,686,074,622	100%

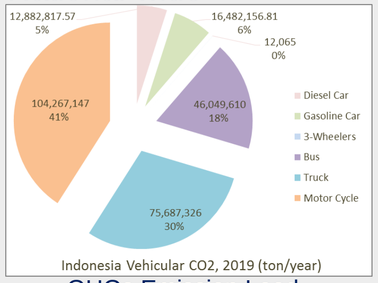
Emissions – Nat'l Wide

- Emissions load –air pollutants– at national-wide is estimated 39,754.51 ton/day (2019), with motor cycle as the largest polluter with 68.80% then is followed by gasoline car, truck, bus, diesel car and three wheelers.
- Meanwhile for CO2 vehicular emission loads at national-wide is estimated 699,674.31 ton/day (2019), again motor cycle as largest polluter with 40.83% or 285,663.42 ton/day then it is followed by truck, bus, gasoline car, diesel car and three wheelers.

Emissions – Greater Jakarta

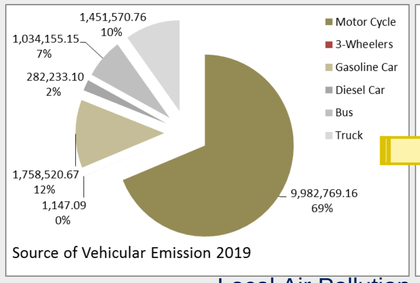
- Emissions load –air pollutants– in the Greater Jakarta is estimated 19,165 ton/day, which sourced by motor cycle (45%), truck (20%), bus (13%), diesel car (6%), gasoline car (16%), and three wheeler (.23%).
- CO2e loads in the Greater Jakarta is estimated 318,840 ton/day which sourced by truck (43%), bus (32%), motor cycle (18%), gasoline car (4%), diesel car (3%), and three-wheeler (.01%).
- Emission load in Greater Jakarta is estimated would be increase 1.8 – 3.5 times in 2030 (BAU, baseline 2012)

National-wide

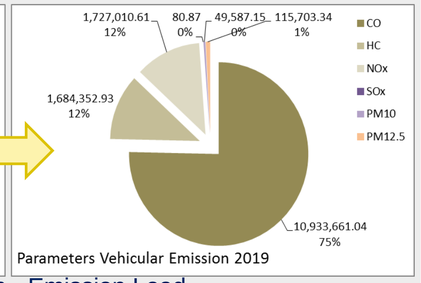


Indonesia Vehicular CO2, 2019 (ton/year)

GHGs Emission Load



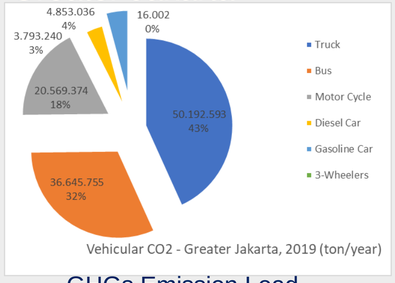
Source of Vehicular Emission 2019



Parameters Vehicular Emission 2019

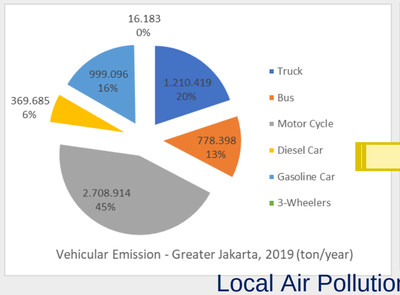
Local Air Pollution - Emission Load

Greater Jakarta

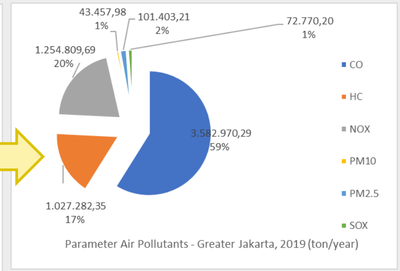


Vehicular CO2 - Greater Jakarta, 2019 (ton/year)

GHGs Emission Load



Vehicular Emission - Greater Jakarta, 2019 (ton/year)



Parameter Air Pollutants - Greater Jakarta, 2019 (ton/year)

Local Air Pollution - Emission Load

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Emission Reduction Strategy

- Local Air Pollution: PM, HC, CO, NOx, O3, SOx:
- Global Green House Gas: CO2

Quality of Energy

MOEMR, MOEF, Pertamina, PGN, PLN, City Government

- ULG
- Low Sulfur Fuels:
  - CNG, LGV
  - Gasoline for Euro 2/II, Euro4/IV Standard
  - Diesel Fuel for Euro 3/III, and 4/IV Standard
  - Fuel with Euro 6 Standard
  - Low Sulfur Industrial Diesel Fuel
  - *Phase-out Dirty Fuels:*
    - RON 88
    - RON 90
    - CN 48 with S> 2000 ppm
    - CN 51 with S > 500 ppm
- Renewable Fuels –
  - Bio-diesel (B10 in 2006, B2.5 in 2007-2009, B0 in 2009-2015, B15% in 2015-2017, B20 in 2017-2019, B30 in 2019-now).
  - Bioethanol (BE10 in 2006 and disappear since 2007).
- *Fuel Economy spec (appropriate RON, ect).*
- *Fuel Handling Evaporated:*
  - Nozzle Evaporated Standard
  - Tank Evaporated Transportation/Storage/Refinery.
- *Clean and Sustainable Fuel for Electricity Supply:*
  - CNG, LNG, LPG (limited)
  - PV Panel (very limited)
  - Hydro Power (limited)
  - Phase out Diesel Power Plant
  - Phase out Coal Fired Power Plant.
- Electricity for Transportation.

Energy Economical Technology

MOI, MOT, MOEF, AUTO-INDUSTRY, City Government

- *Lower Emission Vehicle:*
  - Euro Standard (2/II, 3, and 4)
  - NGV (Natural Gas Vehicle)
  - Soot-free Buses
  - Scrapping Car
- *Low Carbon Emission Vehicle:*
  - Down Sizing
  - Prototype of EV (e-motorcycle, e-passenger vehicle, e-Bus, e-scooter):
    - Operating EV for taxi
    - e-Bus (trial 2019 and 2020)
    - EV running on the road (success on market penetration)
  - Technology Improvement
    - Alt Low Carbon Tech
    - Eco-mode application
    - Automatic turn-off at the idling (limited)
  - Scrapping Car
- Appropriate Car Fuel Filling System (CNG and electrified urban transport).
- Green industry
- Ciller tech.

Implemented/on progress

Not Implemented yet

italics is priority program

Land Use, Traffic and Transport Management

MOI, MOT, MOEF, City Government

TRANSPORTATION:

- Mobility Behavior:
  - Driving Habit:
    - Eco-driving/riding (voluntary)
    - Speed management
    - Vehicle utility
  - Voluntary Public Education Reduce Motor Vehicle Dependency by CSO:
    - TDM and TOD
    - Mass Public Transport: MRT/LRT/BRT
    - NMT: (limited areas in the whole of cities)
      - Walking
      - Cycling
    - First and last mile e-mobility/NMT
    - Road Pricing (not toll)
    - Parking Management
- *Infrastructure (limited to support Sustainable Transportation:*
  - TDM and TOD (on progress)
  - Road, rail, ect. (still imbalance)
  - Underpass/fly-over at the railway crossing
  - NMT: (Walkability City, and Cycling)
  - First and last mile e-mobility/NMT
  - Traffic congestion pricing
    - Road Pricing (not toll)
    - Parking Management
  - Mass Public Transport: MRT/LRT/BRT:
    - CNG, LGV
    - E-Bus
- *Green Freight and Logistic:*
  - CNG, LPG, LNG, soot-free Diesel, e-transporter
  - Eco-driving
- Intelligence Traffic System:
  - Traffic Light (integrated system)
  - Toll gate (Gantry and OBU)
  - ERP Gantry
  - Motor Vehicle dBase

Standard

MOEF, MOI, MO Energy, City Government

- Ambient Air Quality Monitoring (limited in certain cities):
  - By PEMDA
  - By Industrial Estate
  - By Hazardous Industry
- Ambient Air Quality Standard (need to be tightened)
- *Low Emission Vehicle Standard (local air pollution)*
- *Fuel Economy Vehicle Standard/Low Carbon Emission Vehicle Standard*
- *Stringent Emissions Index of Fuels*
- Low Emission Zone, and zero emission zone.

- CARBON DIOXIDE REMOVAL:
  - Sustainable urban agriculture and soil carbon
  - Restoration of degraded lands and protection of primary urban forests/mangrove/wetland/estuary
  - Bio-energy with Carbon capture and storage
  - Direct air Carbon capture and storage

Law Enforcement ‘n (dis)incentive

MOEF, MOT, MO Energy, Traffic Police, City Government

- Incentive/disincentive:
  - *Fiscal*:
    - Low Emission Vehicle
    - Vehicle Carbon Tax
    - Fuel Carbon Tax
  - Non Fiscal
- *Market Driven*:
  - Low Emission Disclosure
  - Fuel Economy/Low Carbon Vehicle Disclosure and or Fuel Economy Labeling
- In-used Vehicle:
  - I/M (voluntary)
  - *Emission Raid.*

Notes: The regulations are complete but officials, bureaucrats and related parties do not carry out the mandate of the constitution and other laws and regulations.

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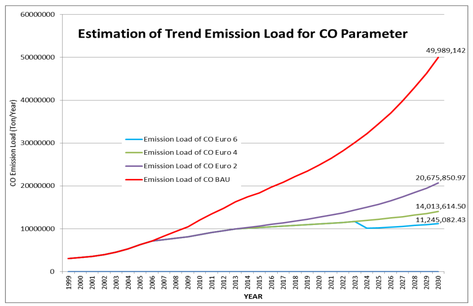
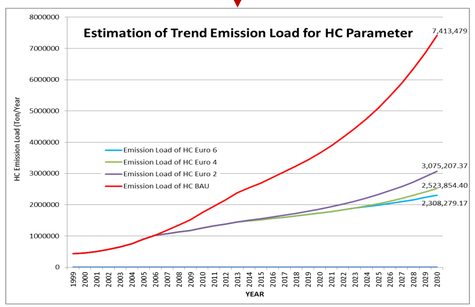
Vehicular Emission Stan'd and Cont'l

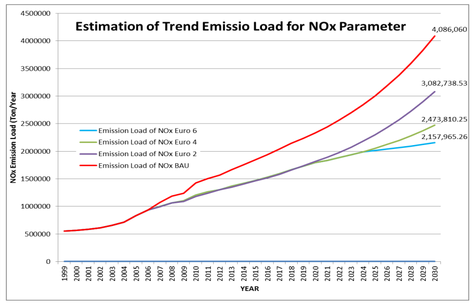
1970	2005	2013	2017	2020	2022	2025	2027	2030	2035
	Euro2/II Standard	Euro3 Standard 2W	Euro4/IV Standard			Euro6/IV Standard			
ICE CV Based Platform	200 gr/km of CO2	LCGC	LCEV			LCEV			
			118 gr/km of CO2 ~ 20Km/L			85 gr/km of CO2~28Km/L			

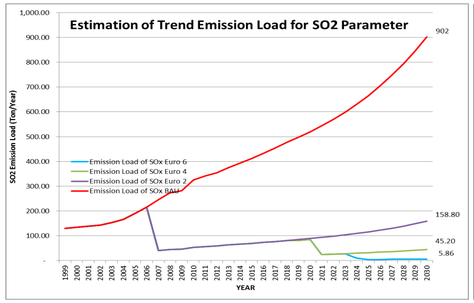
LCEV (Low Carbon Emission Vehicle) tech is addressed to mitigate vehicular CO2: (1) EV (BEV, FCEV, PEV, Hybrid (HEV, PHEV), (2) ICE's: Tech improvement, Flexi-car Tech/biofuels, CNG/LGV/LNG)

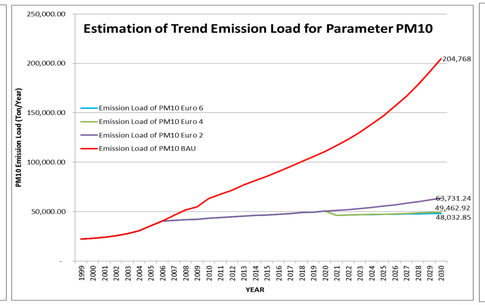
LEV (Low Emission Vehicle) is addressed to mitigate local air pollution of vehicular emission, through adopting Euro Emissions Standard.

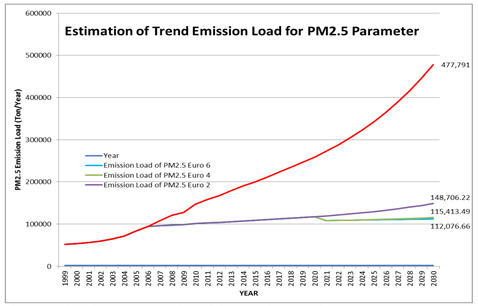




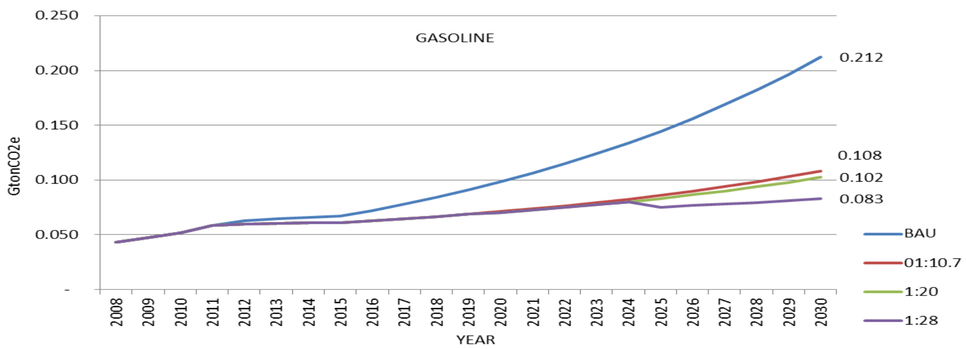


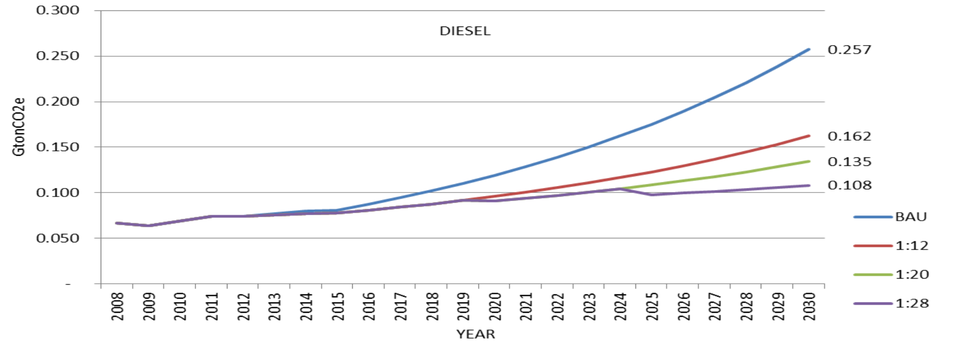






Source: Vehicle Emission Standard in Indonesia, UNEP, 2020





Source: Strategic Plan for Fuel Economy Standard in Indonesia, UNEP, 2020

Effective to Reduce Emission Load by Control Strategy Vehicle Euro Standard

- Avoid LEV and keep dirty fuels of Premium 88, Pertalite 90, Solar 48 and Dexlite 51 could be increasing of air pollution in 2030:
  - ~8x emission load in 2000
  - ~2x emission load in 2019.
  - Increasing cases of illness/dieses related to the air pollution.
  - Tend to increase rain acid, and other environmental degradation.

Fuel Economy Standard: to Mitigate *GtonCO$_2$e* - Road Transportation

- Nat'l (BAU) 2030 ~ 2.82 GtonCO$_2$e
  - Road Transportation 470 MtonCO$_2$e (16.66%):
    - 212 MtonCO$_2$e Gasoline
    - 257 MtonCO$_2$e Diesel
- Scenario Fuel Economy Standard or Low Carbon:
  - 2012 (applied)
    - 9.34 L/100 Km ~ 219.96 grCO$_2$/Km Gasoline
    - 8.33 L/100 Km ~ 216.99 grCO$_2$/Km Diesel
  - 2020 (proposal)
    - 5 L/100 Km ~ 117.75 grCO$_2$/Km Gasoline
    - 5 L/100 Km ~ 130.25 grCO$_2$/Km Diesel
  - 2025 (proposal)
    - 3.57 L/100 Km ~ 84.07 grCO$_2$/Km Gasoline
    - 3.57 L/100 Km ~ 92.99 grCO$_2$/Km Diesel
- Above scenario will decrease GHGs (2030) total 280 MtonCO$_2$e or 59% of BAU:
  - > target NDC (41%)
  - Competitive advantage nat'l auto-industry at regional market Fuel Economy performance 4.4 L/100 Km).
  - Equivalent to saving 59.86 Mio KL gasoline p.a. dan 56 Mio KL diesel fuel p.a. on 2030 ~ Rp 677 trillions.

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Total Cost Ownership of e-Bus vs Diesel and CNG Bus

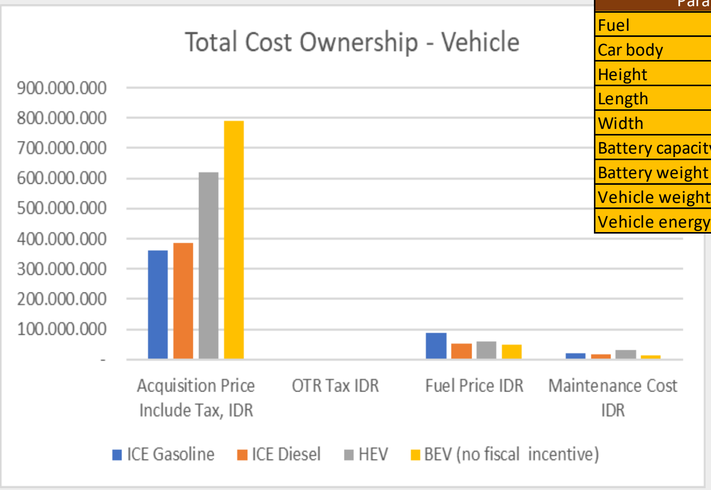
Particular	ICE Diesel Bus with 1800 ppm Dirty Subsidied Fuel	ICE Diesel Bus with 350 ppm Non-Subsied Fuel	ICE CNG-Bus	e-Bus	e-Bus with Incentive Tariff of Electricity
Contractual period (year)	7	7	7	8	8
CAPEX					
Chasis unit price	1.230.000.000	1.230.000.000	2.200.000.000	3.570.000.000	3.570.000.000
Import duty	-	-	-	178.500.000	178.500.000
Importation VAT	-	-	-	357.000.000	357.000.000
Importation Income Tax	-	-	-	89.250.000	89.250.000
Vehicle Tax	29.096.600	29.096.600	29.096.600	55.000.000	55.000.000
Total Price - Chassis unit	1.259.096.600	1.259.096.600	2.229.096.600	4.249.750.000	4.249.750.000
Caroserry	828.500.000	828.500.000	828.500.000	1.050.000.000	1.050.000.000
Air Conditioning	126.400.000	126.400.000	126.400.000		
Replacement Battery	-	-	-		
Replacement Caroserry	-	-	-		
Residu Price	- 126.197.806	- 126.197.806	- 126.197.806	- 302.085.750	- 302.085.750
Insurance and Provision	216.528.867	216.528.867	216.528.867	518.315.550	518.315.550
TOTAL CAPEX	2.304.327.661	2.304.327.661	3.274.327.661	5.515.979.800	5.515.979.800
OPEX					
Maintenance and Reparation	4.599.325.045	4.599.325.045	4.139.392.541	2.667.608.526	2.667.608.526
Fuel	1.200.212.650	2.598.518.650	722.458.100	2.093.737.375	1.871.275.990
Overhaed Cost	110.825.016	110.825.016	110.825.016	62.579.058	62.579.058
TOTAL OPEX	5.910.362.711	7.308.668.711	4.972.675.657	4.823.924.959	4.601.463.574
TOTAL CAPEX + OPEX	8.214.690.372	9.612.996.372	8.247.003.318	10.339.904.759	10.117.443.374
Rp/Km	19.100	22.352	19.176	21.037	20.584
Operation day/year	320	320	320	320	320
VKT/day	192	192	192	192	192

TCO Analysis
EV versus ICE Tech

- Referring to the TCO analysis shows that CAPEX-BEV is relatively more expensive than ICE, and HEV technology.
- However, BEVs have the lowest operating costs, and are effective in mitigating GHGs, making them the best choice for strategies to achieve NDC targets, Net Zero Emissions, and seizing green technology for green growth.
- Fiscal incentives/disincentives are needed to create affordable BEV (TCO):
  - Vehicle
  - Fuel/energy price

Total Consumer Life-Cycle Cost

Passanger Vehicle	Manufacuring Phase		Operation Phase		End-of-Life Phase	Revenue	Total Cost IDR/1500,000 km	Total Cost IDR/km
	Acquisition Price Include Tax, IDR	OTR Tax IDR	Fuel Price IDR	Maintenance Cost IDR	Deregistration Tax IDR	Dismantled Price IDR		
ICE Gasoline	360.255.600		88.727.400	19.213.200	0	- 27.019.170	441.177.030	2.941
ICE Diesel	386.062.200		53.306.100	17.366.400	0	- 28.954.665	427.780.035	2.852
HEV	618.678.000		61.479.000	32.950.800	0	- 46.400.850	666.706.950	4.445
BEV (no fiscal incentive)	791.856.000		49.484.536	13.235.400	0	- 59.389.200	795.186.736	5.301

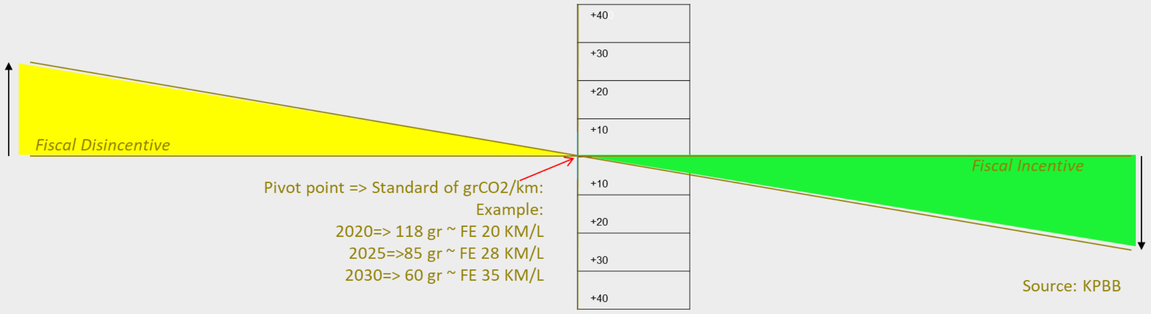


Technical Specification of Selected BEV

Parameter	Value
Fuel	Electricity
Car body	Hatchback
Height	1530 mm
Length	4490 mm
Width	1788 mm
Battery capacity	40 kWh
Battery weight	296 kg
Vehicle weight without battery	1249 kg
Vehicle energy consumption	4.85 km/kWh

Source: Triggering a Strategic Thing of Electrified Vehicle for Transport Decarbonizing in Indonesia, Working Paper, KPBB supported by ClimateWorks Foundation, 2022

Resume and Recommendation



Tax Feebate/Rebate for LCEV, A Trigger for LCEV

Fiscal incentive for LCEV (Low Carbon Emission Vehicle) is taken from excise of vehicle with exceeded grCO2/km standard:

- *Carbon Tax (excise). Motor Vehicles which have* lower **grCO2/km** or the most fuels economy would be gained higher incentive with its consequence to be lower prices of motor vehicle in the market.
- *Monetary measurement. F*iscal *incentive/disincentive of Vehicle Carbon Excise would be charged when purchasing a new vehicle.*
- *Cost neutral principle.*
- *To keep the competitive advantage of domestic product of* LCEV, it is considered to cover total CO2 delivery process of motor vehicle from its manufacturers at separated CO2 calculation for difference fiscal incentive/disincentive (LCA, Life Cycle Analysis).

Excise base on Carbon emission tends to drive people to utilize LCEV. LCEV would be lower price with the most fuel efficiency.

- BEV or Battery Electric Vehicle is the most economic benefits of vehicular emission control strategy (Rp 9,603 trillion by 2030), whether local air pollution and GHGs.
- HEV or Hybrid Electric Vehicle is the next control strategy which generate the most economic benefits (Rp 7,904 trillion by 2030).
- Sustainability on applying control strategy through Euro Standard (Euro 2 by 2005, Euro 3 for 2-wheelers by 2013, Euro 4 by 2018, and Euro 6 by 2025; would be generate economic benefits Rp 3,493 trillion by 2030.
- Scrappage car program also generates economic benefits significantly.
- Economic benefits are generated by fuel saving (energy efficiency), health improvement, and production saving.

CBA LEV/LCEV

Particular	Policy Option						
	Euro 2 since 2005*	Euro 3 Since 2013 (2/3-Wheelers)	Euro 4 (Since 2020)*	Euro 6 (Since 2025)	HEV*	BEV	Scrappage Car*
Cost							
Refinery/Energy Storage Production	467,416	0	466,745	926,550	338,794	387,452	464,669
Technology Utilization	493,312	390,921	493,312	540,769	784,586	722,604	30,911
Total Cost	960,728	390,921	960,057	1,467,319	1,123,380	1,110,056	495,580
Benefit							
Health Improvement	1,656,264	2,706,545	1,648,305	2,873,522	2,854,542	3,468,269	1,667,728
Production Saving	27,712	45,285	31,387	54,718	448,393	544,797	36,237
Fuel/Energy Saving	286,392	468,001	324,084	564,982	4,601,071	5,590,301	373,975
Total Benefit	1,970,368	3,219,831	2,003,776	3,493,221	7,904,006	9,603,367	2,077,940
FY Until 2030							
Net Benefit	1,009,640	2,828,910	1,043,719	2,025,903	6,780,626	8,493,312	1,582,360
NPV; SDR 8%	38,963	166,967	47,736	338,787	1,563,678	3,264,400	290,778
Net Benefit Average	38,832	166,406	40,143	337,650	260,793	1,415,552	60,860
FY Until 2030							
Fuel Saving	286,392	468,001	324,084	564,982	4,601,071	5,590,301	373,975
NPV; SDR 8%	71,395	178,434	84,727	293,791	1,098,827	1,118,060	91,202
Net Benefit Average	13,018	27,529	14,731	94,164	209,140	559,030	16,999

1. Various cities in Indonesia are still facing the threat of air pollution from various sources, especially from motorized vehicles, e.g. Jakarta, which has experienced unhealthy air quality for three decades.
2. On time adopting LEV and LCEV will provide triple benefits for Indonesia:
   i. Reduce vehicular emission almost 100% of urban air pollution, and ~280 MtonCO2e or 59% of BAU of GHGs (470 MtonCO2e) in 2030;
   ii. Gain economic benefits of thousands trillion Rupiahs in 2030 as a consequence of improving public health, and people productivity which is better air quality, and energy savings *–59.86 Mio-KL gasoline, and 56 Mio-KL diesel fuel p.a. equivalent to IDR 677 T–* and its multiplier effects;
   iii. Triggering green economic growth through the automotive and energy sector.
3. Even more with Indonesia success in developing low carbon of EV prototypes, and the abundant supply of raw materials for EV's battery (mining of Ni, Co, rare earth); are competitive advantages which positions Indonesia as an important part of the global EV manufacturing supply chain.
4. As a low-carbon vehicle, EV is a proven technology that we must seize, so that the above triple benefits can really be reaped for the inevitability of green economic growth, and prosperity of the nation.
5. LCEV-based fiscal (dis)incentive would be a trigger, and paving the way to accelerate LEV, and LCEV deployment in Indonesia.

Terimakasih

Thank you

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