



Peluncuran dan Diskusi Laporan Pengetatan
Standar Kualitas BBM
Jakarta 19 November 2024



FUEL EMISSION, HEALTH IMPACTS, COST OF ILLNESS AND ENERGY TRANSITION SCENARIO IN INDONESIA

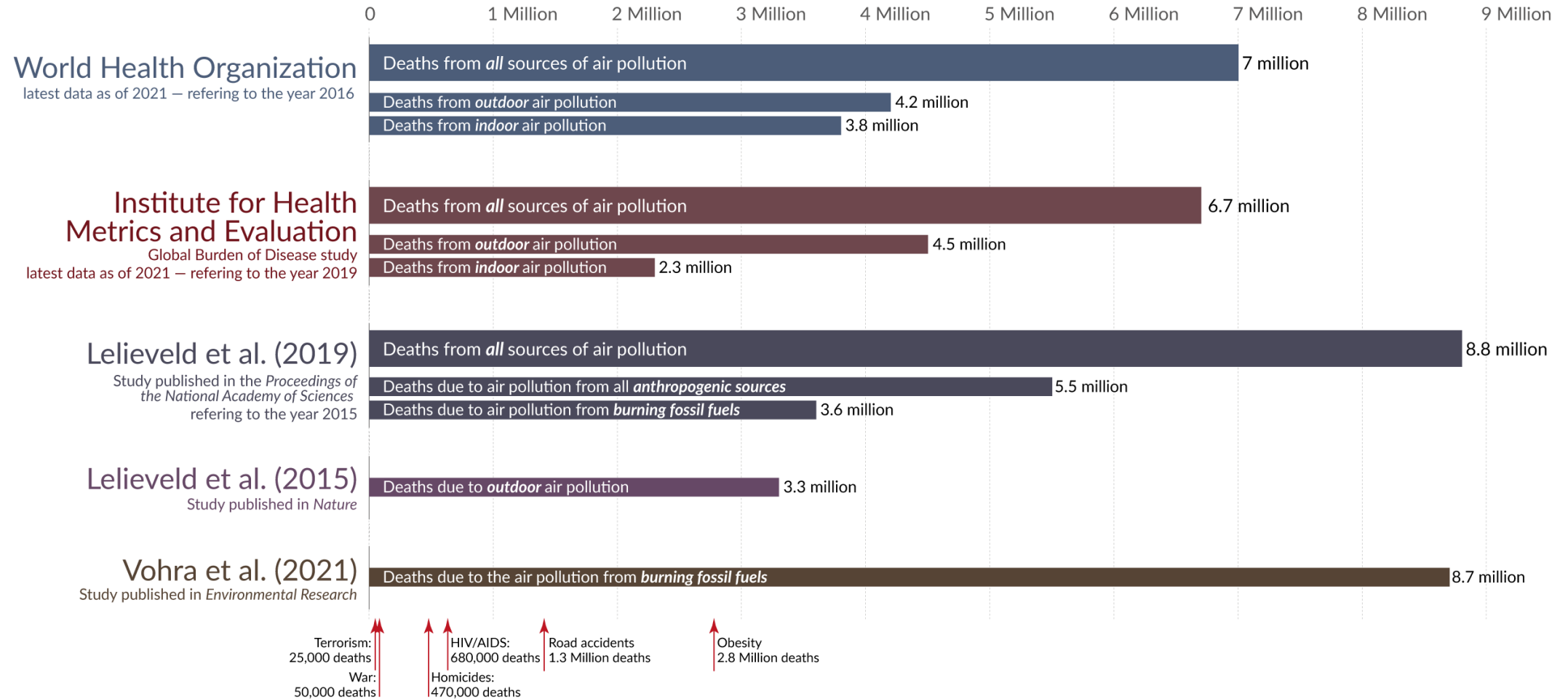
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Dept. of Environmental Health,
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How many people die from air pollution each year?

Estimates of the global death toll from air pollution published in major recent studies

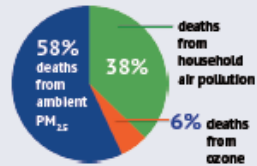
'All sources' includes both anthropogenic and natural sources:

- The largest source of natural air pollution is airborne dust in the world's deserts. Other natural sources are fires, sea spray, pollen, and volcanoes.
- Anthropogenic sources include electricity production; the burning of solid fuels for cooking and heating in poor households; agriculture; industry; and road transport.



Data on annual death tolls from other causes is the latest data from the World Health Organization, UCDP, and Global Terrorism Database as of November 2021.

8.1 million due to air pollution in 2021



2nd

largest risk factor of deaths in 2021

Countries in South Asia and Africa face the highest burden of disease.

Global Risk Factors for Death

1. High blood pressure
2. Air pollution
3. Tobacco
4. Diet
5. High fasting plasma glucose

Since 2000

The disease burden for household air pollution (HAP) has decreased largely due to reductions in exposure in China and South Asia.

There has been a **36%** decline in deaths from HAP.

Air pollution is responsible for



30% of deaths from lower respiratory infections.

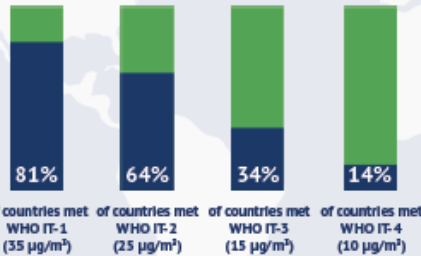


28% of deaths from ischemic heart disease.



48% of deaths from chronic obstructive pulmonary disease.

Lower respiratory infection deaths are decreasing across most regions.



The interim targets (ITs) were developed based on current scientific evidence and are intended to be used in diverse conditions to support air quality management.

For more, see the WHO air quality guidelines.

↓ Globally, ambient PM_{2.5} levels are reducing or stabilizing in many regions.

31.3 µg/m³ average global exposure of ambient PM_{2.5}

Populations from low- and middle-income countries are exposed to **1.3–4 times** higher levels of ambient PM_{2.5}.



Global Risk Factors for Death for Children Under 5 Years

1. Malnutrition
2. Air pollution
3. Water, sanitation, and hygiene
4. High or low temperature
5. Tobacco

Children Under 5

709,000 total deaths from air pollution in 2021. The largest burden of disease is seen in Asia and Africa.



air pollution-related deaths by pollutant

The Good News

The disease burden linked to air pollution in children under 5 has decreased by **35%** since 2010, driven largely by reductions in HAP.

2nd

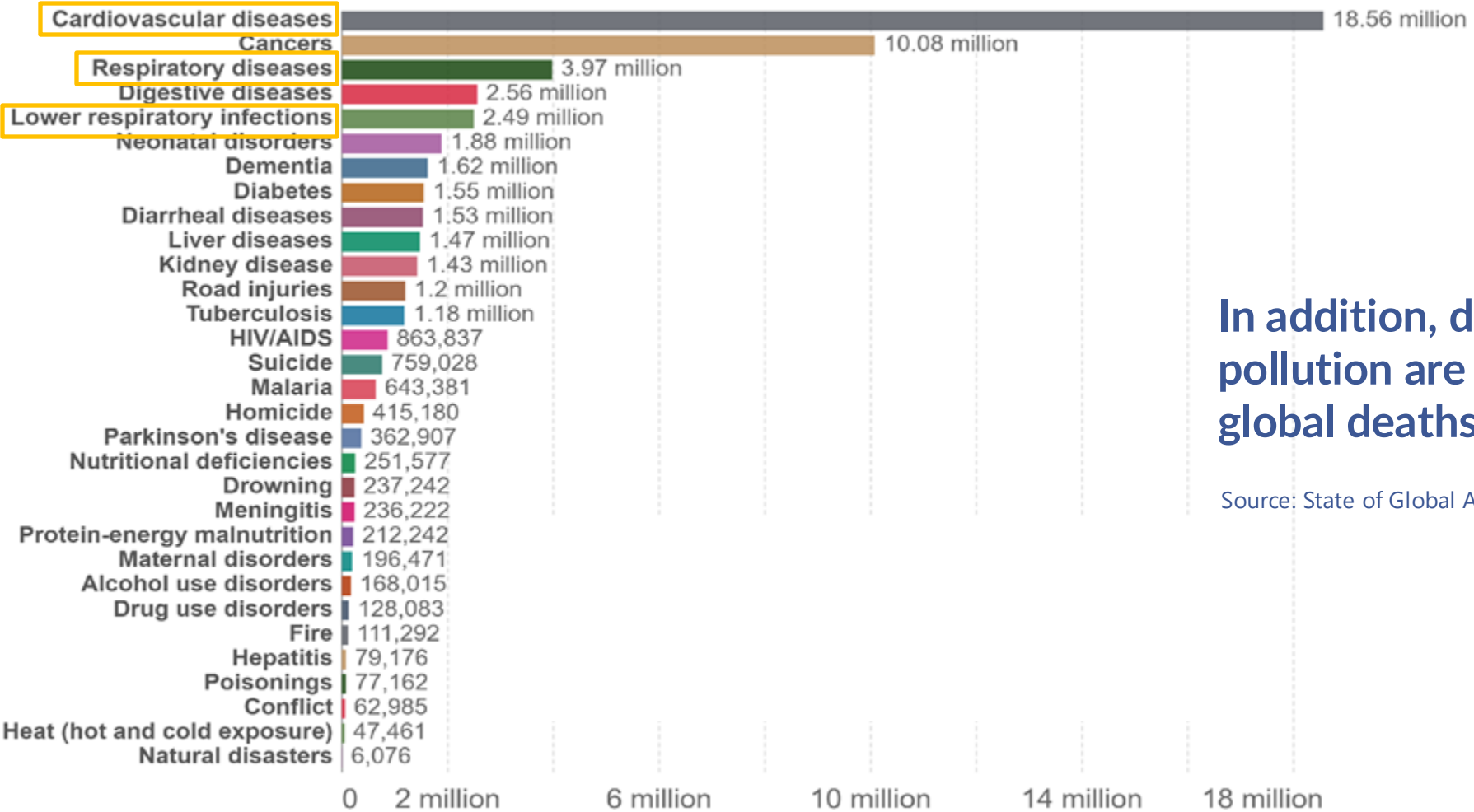
largest risk factor of deaths in 2021

In South Asia and East, West, Central and Southern Africa, air pollution accounts for nearly 30% of all deaths in the first month after birth.

CURRENT HEALTH IMPACTS OF AIR POLLUTION WORLDWIDE

WHO has named air pollution as the world's largest environmental health risk

Number of deaths by cause, World, 2019



In addition, diseases-related to air pollution are the main causes of global deaths

Source: State of Global Air, 2024

Source: IHME, Global Burden of Disease

OurWorldInData.org/causes-of-death • CC BY

THE HEALTH EFFECTS OF AIR POLLUTION

BRAIN & NERVOUS SYSTEM

- Dementia
- Impaired Motor Functions
- Impaired Cognitive Functions
- Strokes
- Reduced Intelligence
- Mental Health Problems

CARDIOVASCULAR SYSTEM

- Increased Risk of Heart Attack
- Atherosclerosis
- Changes in Heart Function
- Increased Heart Rhythm Problems

ABDOMINAL ORGANS

- Increased IBS
- Bladder Cancer
- Gut Cancer
- Liver Damage
- Kidney Damage

RESPIRATORY SYSTEM

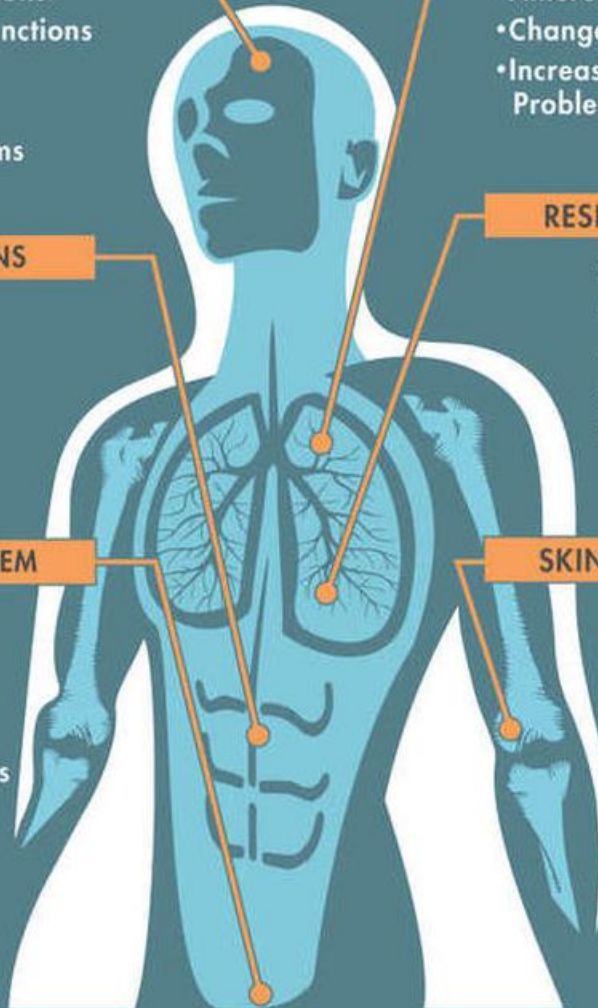
- Respiratory Impairment
- Asthma
- Emphysema
- Lung Cancer
- Increased COPD

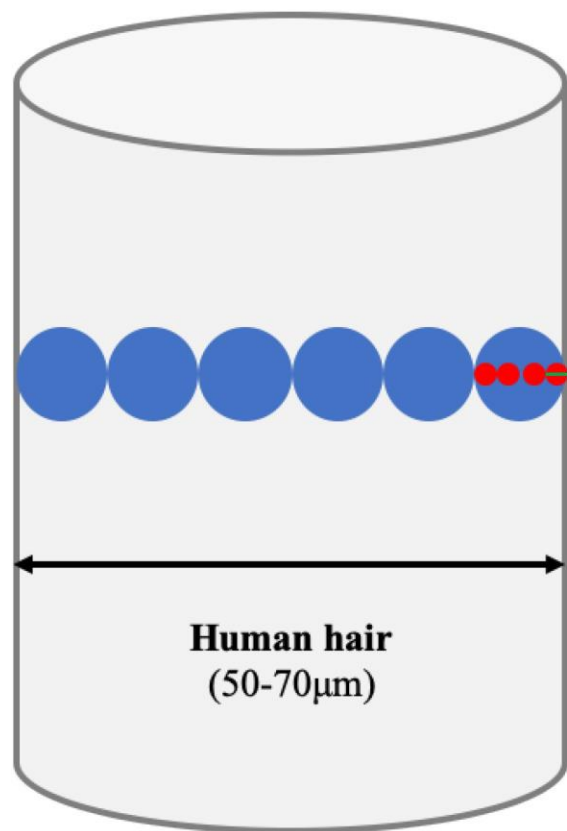
REPRODUCTIVE SYSTEM


- Fertility Problems (Male & Female)
- Miscarriage
- Premature Birth
- Fetal Growth Problems
- Low Birth Weight
- Cancer Risk in Both Male & Female


SKIN, BLOOD & BONES


- Skin Aging
- Hives
- Brittle Bones
- High Blood Pressure
- Trombosis
- Leukemia & Blood Cancer

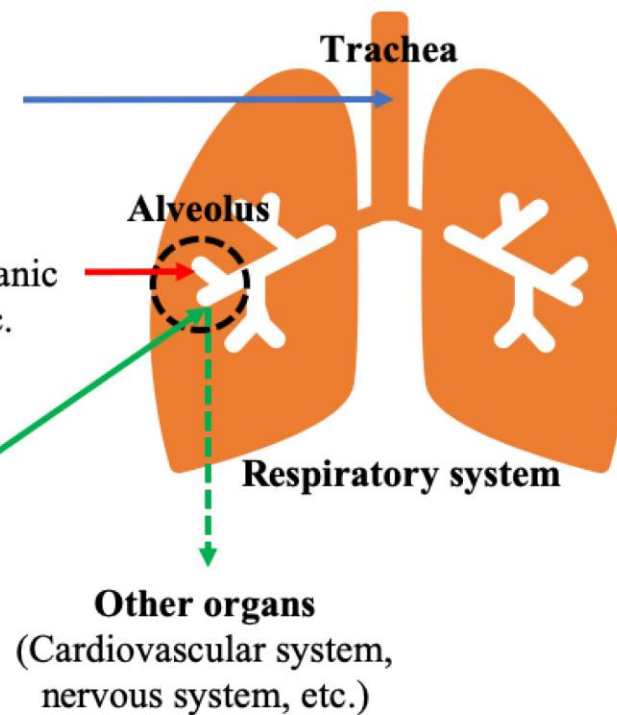




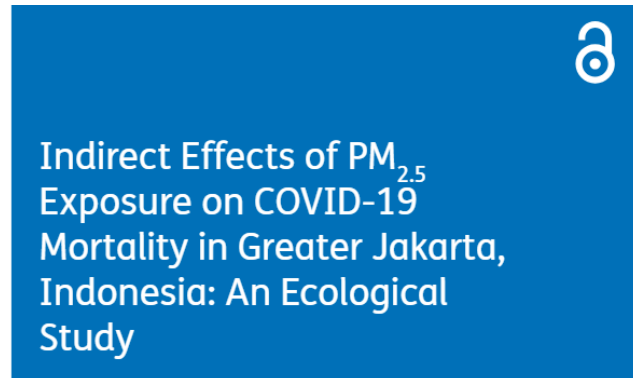
 **PM₁₀** (<10 μm)
Dust, pollen, mold, etc.

 **PM_{2.5}** (<2.5 μm)
Combustion particles, organic compounds, metals, etc.


 **PM_{0.1}** (<0.1 μm)
Virus, gaseous contaminants, etc.
10X



PM_{2.5} and COVID-19 Deaths in Jakarta



Indirect Effects of PM_{2.5}
Exposure on COVID-19
Mortality in Greater Jakarta,
Indonesia: An Ecological
Study

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INDANG TRIHANDINI 
FAJAR NUGRAHA 
FITRI KURNIASARI 

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May 2024

Annals of
Global Health

ORIGINAL RESEARCH

]u[ubiquity press

- Short-term exposure to PM_{2.5} showed a negative correlation with COVID-19 mortality.
- The regression analysis estimate that a 50 µg/m³ increase in long-term average PM_{2.5} could lead to an 11.9% rise in the COVID-19 mortality rate.
- This suggests that COVID-19 mortality is more strongly influenced by prolonged PM_{2.5} exposure rather than short-term exposure alone.

POLICY NOTE 2022

The Study of Air Pollution and Health Impacts of Energy Emissions in the Transportation Sector

Kementarian PPN/Bappenas, World Resource Institute,
Agence Francaise Developpement

30 October 2022

Risk of Diseases-related Air Pollution in Jakarta (2016-2021), Bandung & Palembang (2014-2021)

- An increase per $10 \mu\text{g}/\text{m}^3$ $\text{PM}_{2.5}$ was associated with a 5.7%, 6% and 3.8% increase of Pneumonia cases in Jakarta, Bandung & Palembang respectively
- An increase per $10 \mu\text{g} / \text{m}^3$ $\text{PM}_{2.5}$ correlated with a 1.1% increase in bronchopneumonia cases in Bandung
- An increase per $10 \mu\text{g}/\text{m}^3$ SO_2 was associated with a 6.7% increase of Pneumonia cases
- An increase per $10 \mu\text{g}/\text{m}^3$ PM_{10} was associated with a 1.4% & 10% increase of Acute Respiratory Infection cases in Jakarta & Palembang respectively

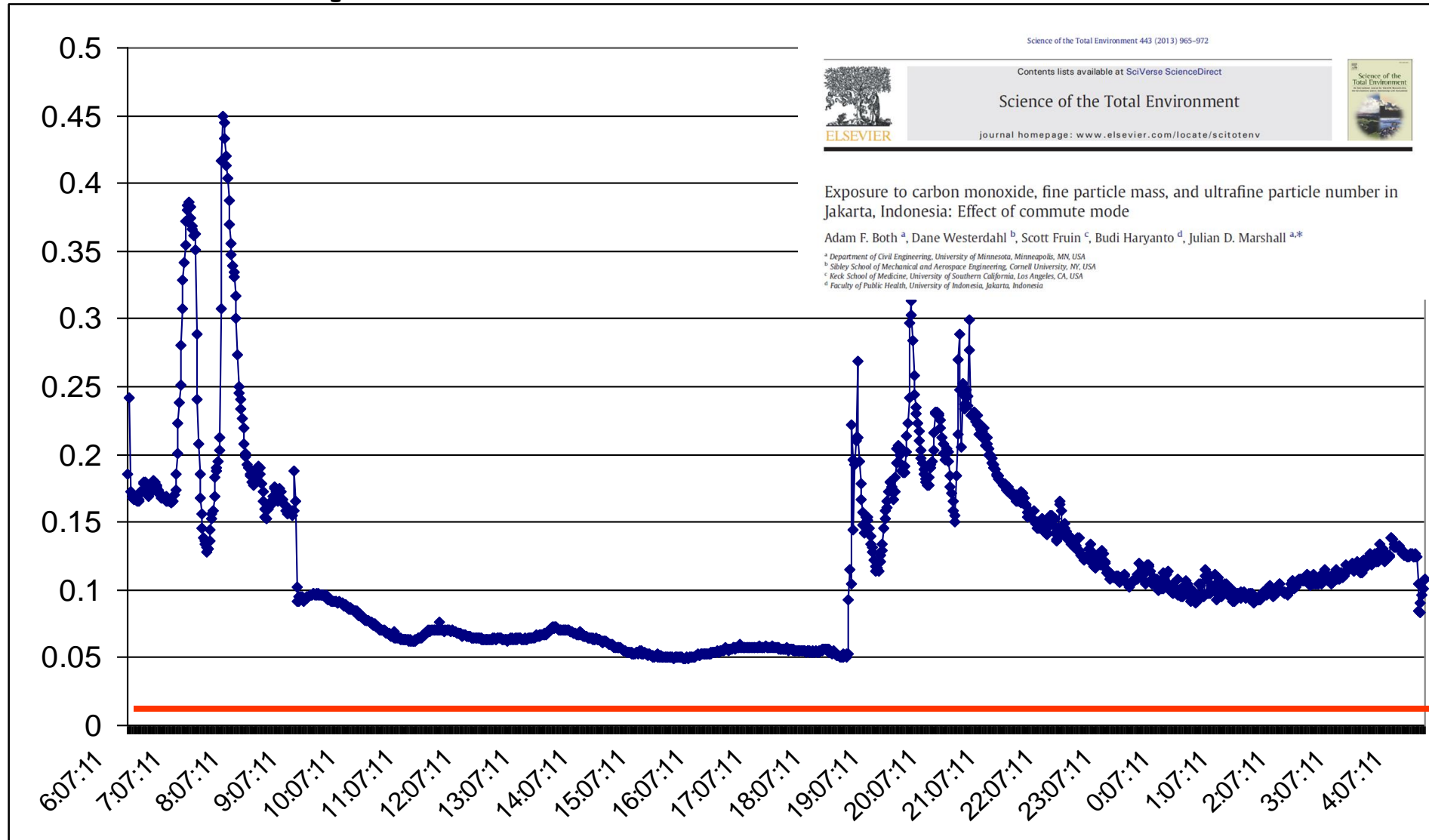
Diseases-related to Air Pollution & BPJS's Claimed in Jakarta



| Year | Asthma | | Bronchopneumonia | | ARI | | Pneumonia | |
|--------------|----------------|------------------------|------------------|------------------------|----------------|------------------------|----------------|------------------------|
| | Cases | Total claim (1000 IDR) | Cases | Total claim (1000 IDR) | Cases | Total claim (1000 IDR) | Cases | Total claim (1000 IDR) |
| 2016 | 12,132 | 8,364,033 | 6,013 | 31,859,629 | 21,394 | 13,079,906 | 7,925 | 83,374,323 |
| 2017 | 58,961 | 41,580,473 | 36,271 | 166,268,240 | 139,639 | 80,230,685 | 41,623 | 354,404,451 |
| 2018 | 73,736 | 46,380,761 | 41,642 | 173,564,617 | 141,552 | 81,613,390 | 43,434 | 377,151,508 |
| 2019 | 81,197 | 46,569,495 | 45,223 | 179,326,540 | 164,182 | 98,291,934 | 51,793 | 442,414,052 |
| 2020 | 54,062 | 24,170,188 | 29,958 | 104,209,999 | 88,422 | 47,785,977 | 42,730 | 296,621,007 |
| 2021 | 56,780 | 24,194,341 | 16,756 | 61,975,426 | 43,776 | 20,725,985 | 37,780 | 259,248,127 |
| Total | 336,868 | 191,259,290 | 175,863 | 717,204,452 | 598,965 | 341,727,877 | 225,285 | 1,813,213,468 |



PM_{2.5} MOBIL PRIBADI - A.C. Depok – Gatot Subroto (mg/m³)



Science of the Total Environment 443 (2013) 965–972



Contents lists available at SciVerse ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv



Exposure to carbon monoxide, fine particle mass, and ultrafine particle number in Jakarta, Indonesia: Effect of commute mode

Adam F. Both ^a, Dane Westerdahl ^b, Scott Fruin ^c, Budi Haryanto ^d, Julian D. Marshall ^{a,*}

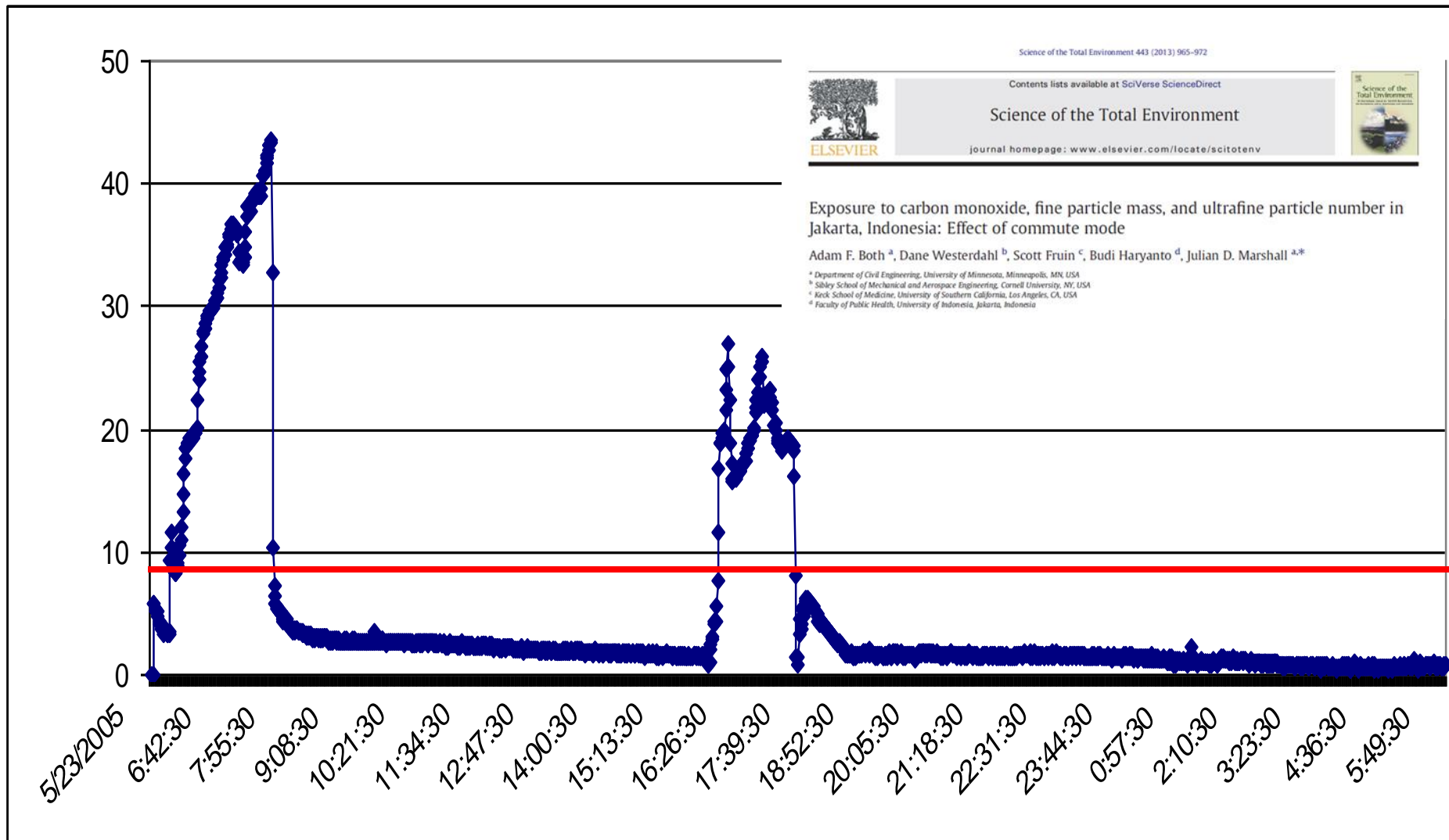
^a Department of Civil Engineering, University of Minnesota, Minneapolis, MN, USA

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^c Keck School of Medicine, University of Southern California, Los Angeles, CA, USA

^d Faculty of Public Health, University of Indonesia, Jakarta, Indonesia

CO Mobil Pribadi ber-AC Ciputat – Salemba (ppm)



Diseases-related to Air Pollution in Jakarta (UI-KLHK-UNEP 2010)

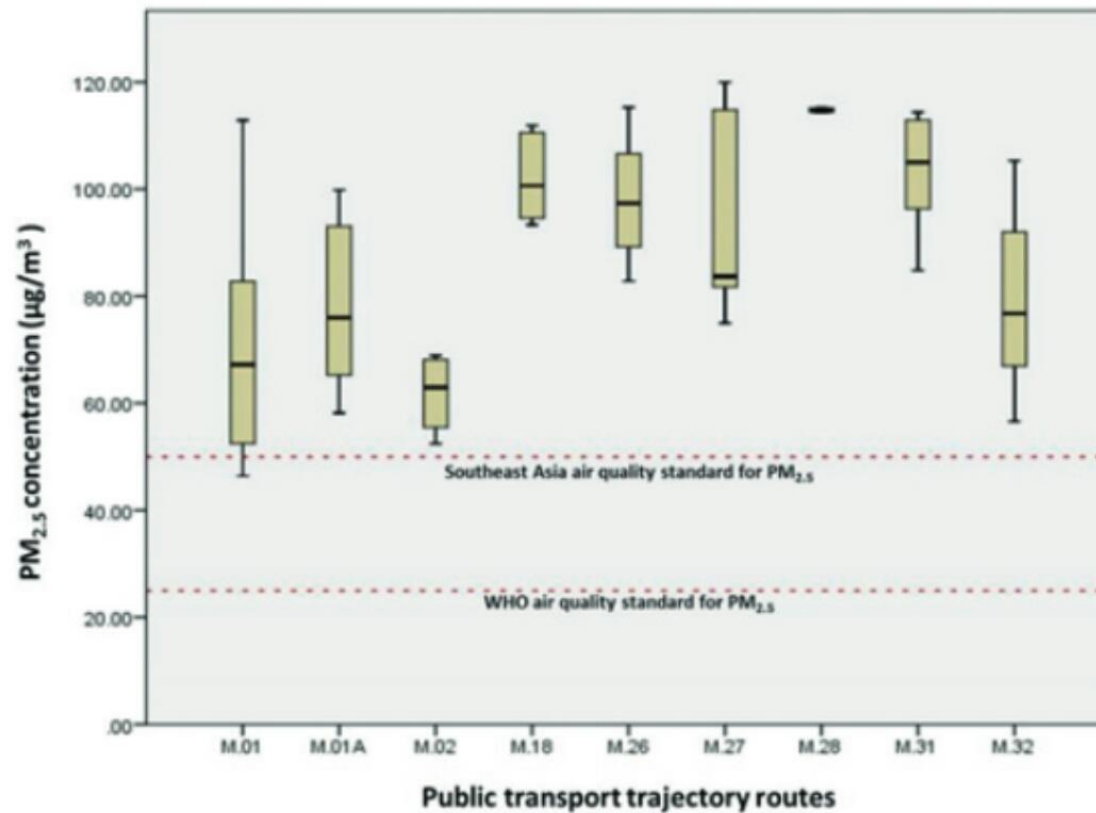
- 1,210,581 people suffered by asthmatic bronchiale (12.6%)
- 153,724 people with bronchopneumonia (1.6%)
- 2,449,986 with ARI (25.5%)
- 336,273 people with pneumonia (3.5%)
- 153,724 people with COPD (1.6%)
- 1,246,130 people with coronary artery diseases (13.0%)

57.8% of the Jakarta population had already suffered by various air pollution-related diseases in 2010

Exposure to PM_{2.5} and Lung Function Impairments on the Public Transportation Drivers in Jakarta 2019

56% adult male impaired lung function

Tia Prabawati Suhengsi^a, Budi Haryanto^{a*}
Submitted to **Akademi Sains Malaysia Journal** (Q2)



Effect of particulate matter 2.5 exposure to urinary malondialdehyde levels of public transport drivers in Jakarta

Damai Arum Pratiwi and Budi Haryanto ✉

DOI: <https://doi.org/10.1515/reveh-2020-0017> | Published online: 08 Jul 2020

Cost of Illness



(UI-KLHK-UNEP 2010)

| Health Impacts | Incidence Per 100,000 | Cost per patient | | Estimated cost in Jakarta | |
|--------------------------|--------------------------|------------------|------------|---------------------------|---------------------------|
| | | Minimum | Maximum | Minimum | Maximum |
| Asthmatic bronchiale | 12,600.0 | 173,972 | 4,418,618 | 210,607,225,915 | 5,349,095,712,874 |
| Bronchopneumonia | 1,600.0 | 91,500 | 3,650,813 | 14,065,837,500 | 561,221,228,425 |
| ARI | 25,500.0 | 92,142 | 4,774,843 | 225,746,580,987 | 11,698,296,998,123 |
| Pneumonia | 3,500.0 | 109,738 | 5,455,359 | 36,901,876,543 | 1,834,489,937,007 |
| COPD | 1,600.0 | 164,161 | 5,276,800 | 25,235,582,747 | 811,176,080,000 |
| Coronary artery diseases | 12,970.0 | 148,763 | 14,647,900 | 185,378,033,307 | 18,253,187,244,690 |
| Total | | | | 697,935,136,999 | 38,507,467,201,119 |

US \$ 53,846,154 – 2,962,112,861

Article

Impacts of Air Pollution on Health and Cost of Illness in Jakarta, Indonesia

Ginanjari Syuhada¹, Adhadian Akbar², Donny Hardiawan², Vivian Pun¹, Adi Darmawan³, Sri Hayyu Alynda Heryati³, Adiatma Yudistira Manogar Siregar², Ririn Radiawati Kusuma¹, Raden Driejana⁴, Vijendra Ingole⁵, Daniel Kass⁵ and Sumi Mehta^{5,*}

Jakarta 2022:

(infant deaths, stunting, adverse birth outcomes, mortality, & hospitalization)

- Air pollution potentially caused more than 10,000 deaths
- 5000+ hospitalizations for cardio-respiratory diseases
- 7000+ adverse health outcomes in children
- Cost of Illness 2019 USD 2,943.42 million.

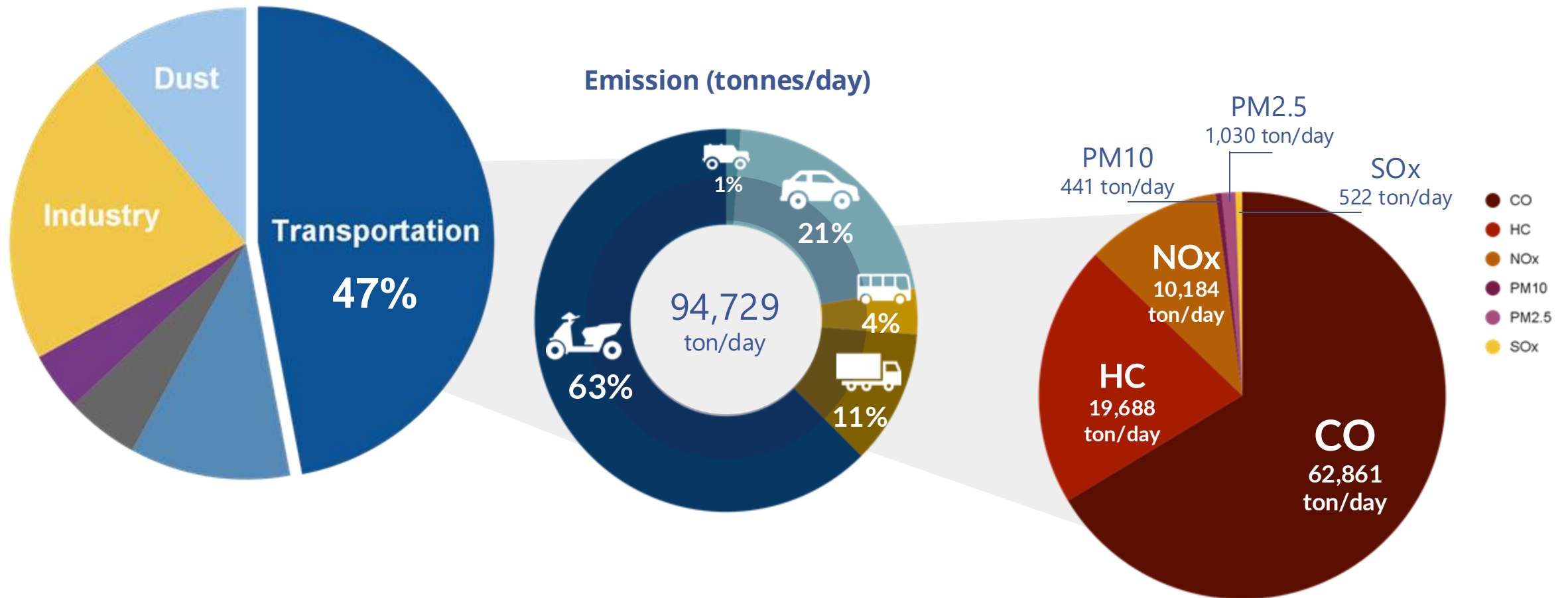


IMPROVEMENT AIR QUALITY THROUGH BETTER FUEL QUALITY TRANSFORMATION IN INDONESIA 2024-2030

Kementerian Koordinator Maritim dan Investasi

Rabu, 2 Oktober 2024

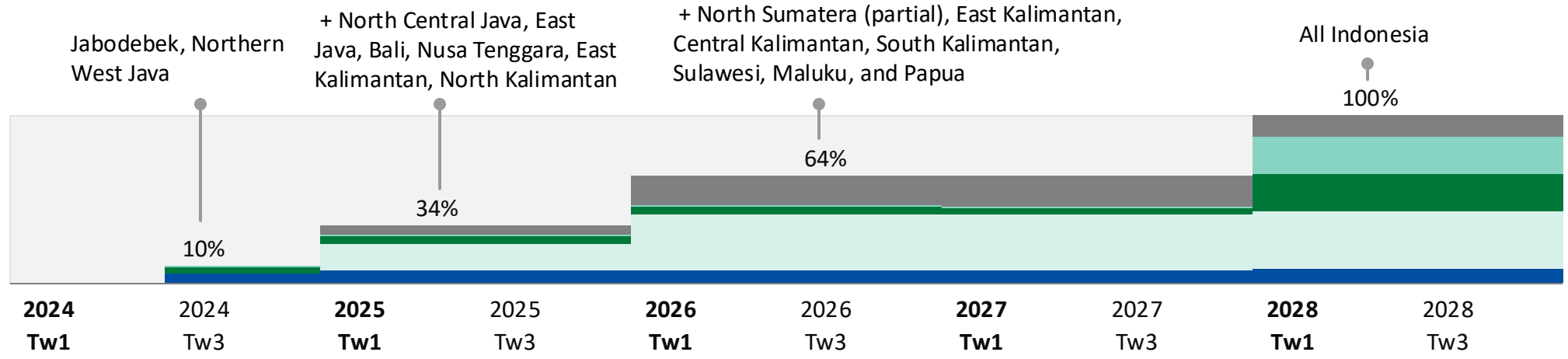
In Indonesia, 47% air pollution contributed by transportation activities



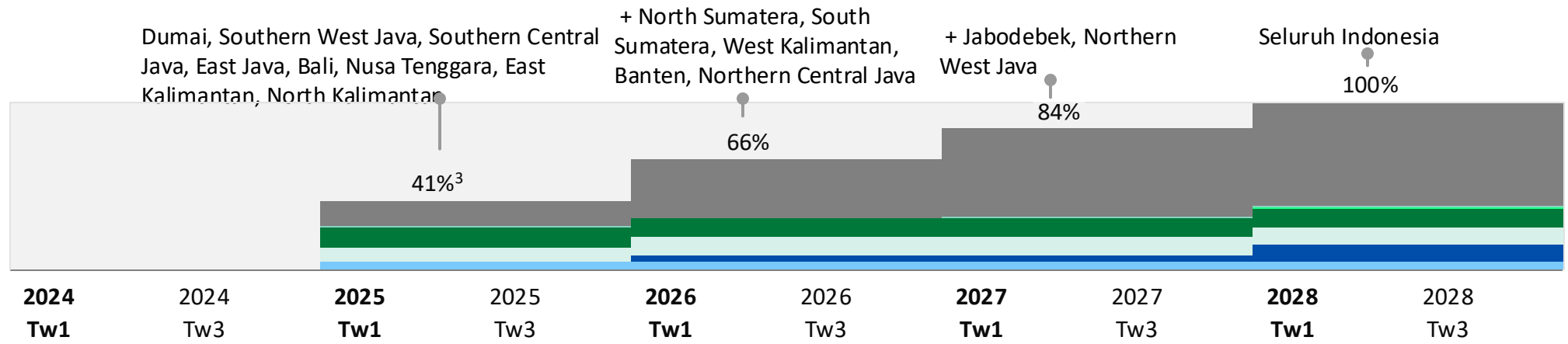


"Provision of Low-Sulfur Fuel 50 ppm Can Begin Soon for Diesel, 2025 for Gasoline - Gradually According to the Readiness of Pertamina's Refineries"

Provision of diesel¹ 50 ppm sulfur (Subsidized and Non-subsidized Biosolar)



Provision of gasoline² 50 ppm sulfur (Pertalite and Pertamax)



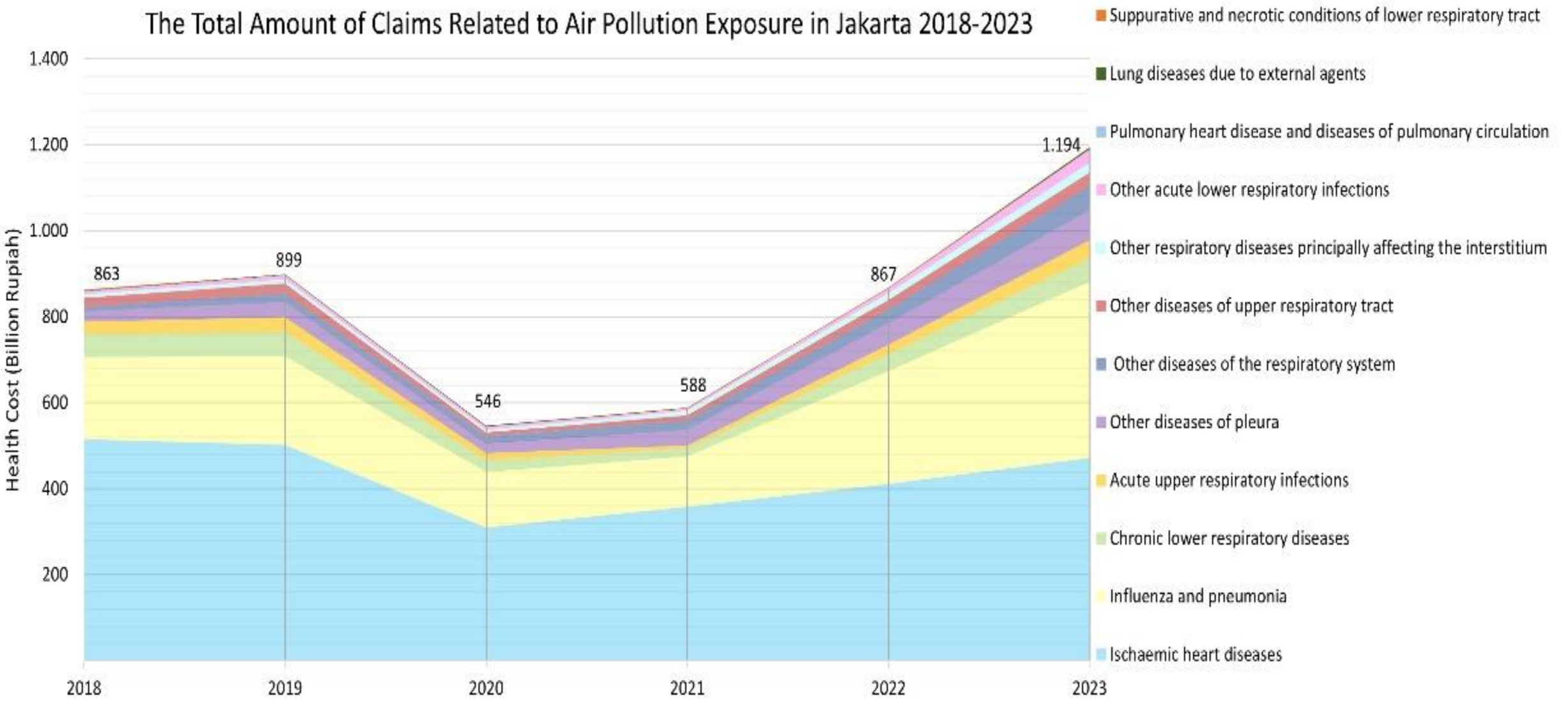
■ tImpor PPN ■ RU II Dumai ■ RU III Plaju ■ RU IV Cilacap ■ RU V Balikpapan ■ RU VI Balongan ■ TPPI Tuban

1. Volume solar subsidi dan non subsidi B35 termasuk industri; 2. Volume Pertalite dan Pertamax; 3. Kemampuan sarana fasilitas penerimaan impor di Cilacap pada tahun 2025 masih dalam proses kajian
 Sumber: Estimasi Pertamina

Claim of National Health Insurance for Diseases-related to Air Pollution in Jakarta 2016-2023

| Health Impacts | Incidence | Cost per patient | | Estimated cost in Jakarta | |
|---|-----------|------------------|------------|---------------------------|------------------------|
| | | Minimum | Maximum | Minimum | Maximum |
| Suppurative and necrotic conditions of lower respiratory tract | 166 | 4.550.589 | 25.960.359 | 40.955.300 | 441.326.100 |
| Other acute lower respiratory infections | 9.675 | 2.526.839 | 3.613.218 | 1.205.302.300 | 4.169.653.700 |
| Influenza and pneumonia | 48.048 | 7.385.305 | 9.463.772 | 27.146.703.810 | 43.660.319.920 |
| Acute upper respiratory infections | 56.571 | 633.775 | 838.163 | 2.200.466.300 | 5.919.565.800 |
| Ischaemic heart diseases | 40.068 | 10.985.941 | 12.379.880 | 28.598.912.900 | 45.644.304.300 |
| Pulmonary heart disease and diseases of pulmonary circulation | 222 | 2.966.592 | 13.679.527 | 35.599.100 | 361.514.000 |
| Chronic lower respiratory diseases | 32.474 | 1.505.448 | 1.909.099 | 3.436.937.725 | 5.649.023.000 |
| Other diseases of pleura | 3.061 | 14.910.713 | 33.681.397 | 3.533.839.000 | 9.195.021.400 |
| Other diseases of upper respiratory tract | 13.435 | 2.061.453 | 2.616.089 | 1.704.051.100 | 3.038.023.500 |
| Other diseases of the respiratory system | 1.948 | 16.477.690 | 36.248.147 | 2.059.711.200 | 7.826.360.500 |
| Lung diseases due to external agents | 129 | 4.359.778 | 39.955.493 | 39.238.000 | 371.265.600 |
| Other respiratory diseases principally affecting the interstitium | 1.943 | 8.639.670 | 15.046.554 | 1.227.115.800 | 2.783.612.500 |
| Total | | | | 71.228.832.535 | 129.059.990.320 |

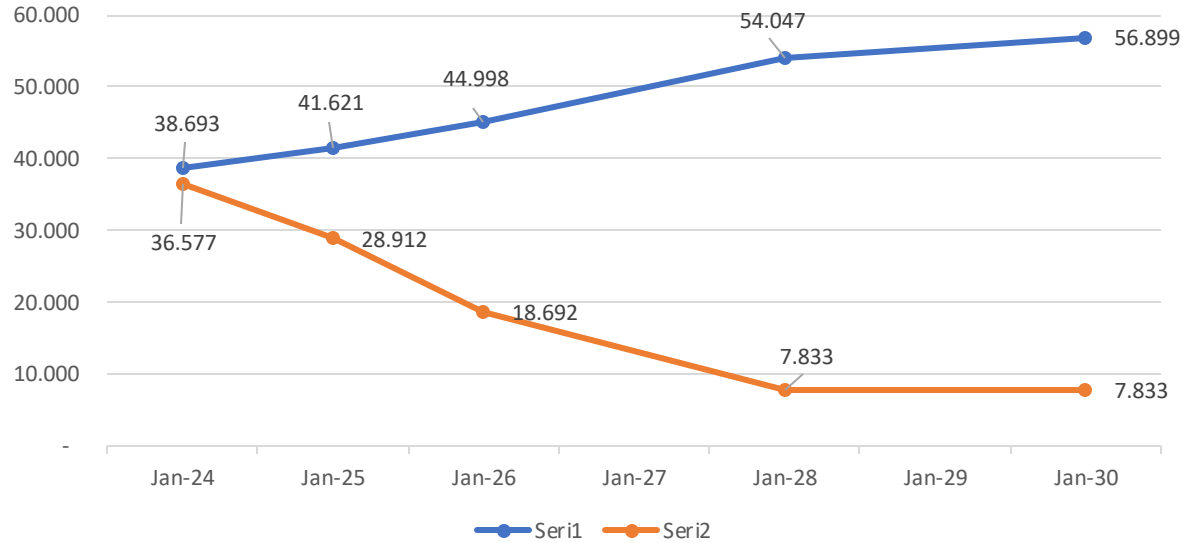
The Total Amount of Claims Related to Air Pollution Exposure in Jakarta 2018-2023



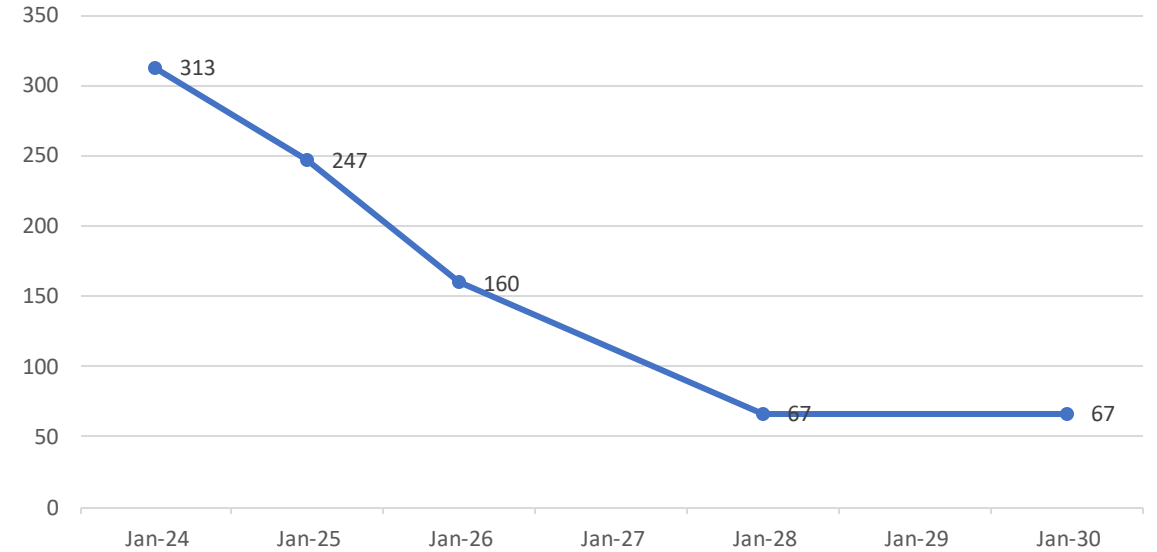
The Risk of Pneumonia, Chronic Obstructive Pulmonary Disease (COPD) and Ischemic Heart Disease Exposed by PM_{2.5} in Jakarta 2018-2023

- Every increasing of concentration of 15 ug/m³ PM_{2.5} associated with the raise of 20% cases of pneumonia.
- Every increasing of concentration of 15 ug/m³ PM_{2.5} associated with the raise of 27% cases of COPD (Chronic Obstructive Pulmonary Disease).
- Every increasing of concentration of 15 ug/m³ PM_{2.5} associated with the raise of 37% cases of Ischemic Heart Disease.

ESTIMATED PNEUMONIA CASES BASED ON EURO 4 FUEL
SCENARIO 10%, 34%, 66%, 100%
IN JAKARTA 2024-2030 (86% REDUCTION)

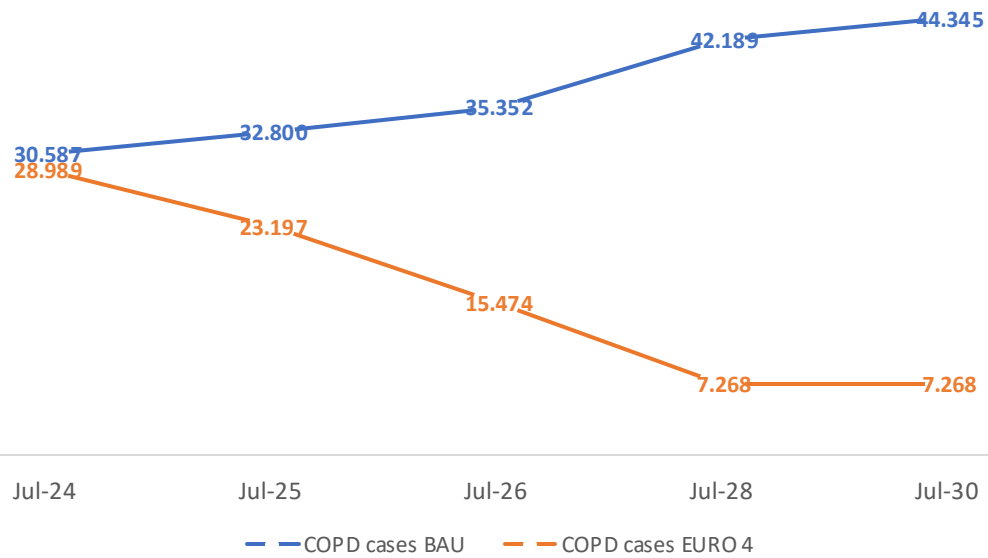


IMPLEMENTATION OF EURO 4 SCENARIO AND COST OF
TREATMENT BPJS'S CLAIM FOR PNEUMONIA IN JAKARTA
(IDR 246 BILLION REDUCTION)

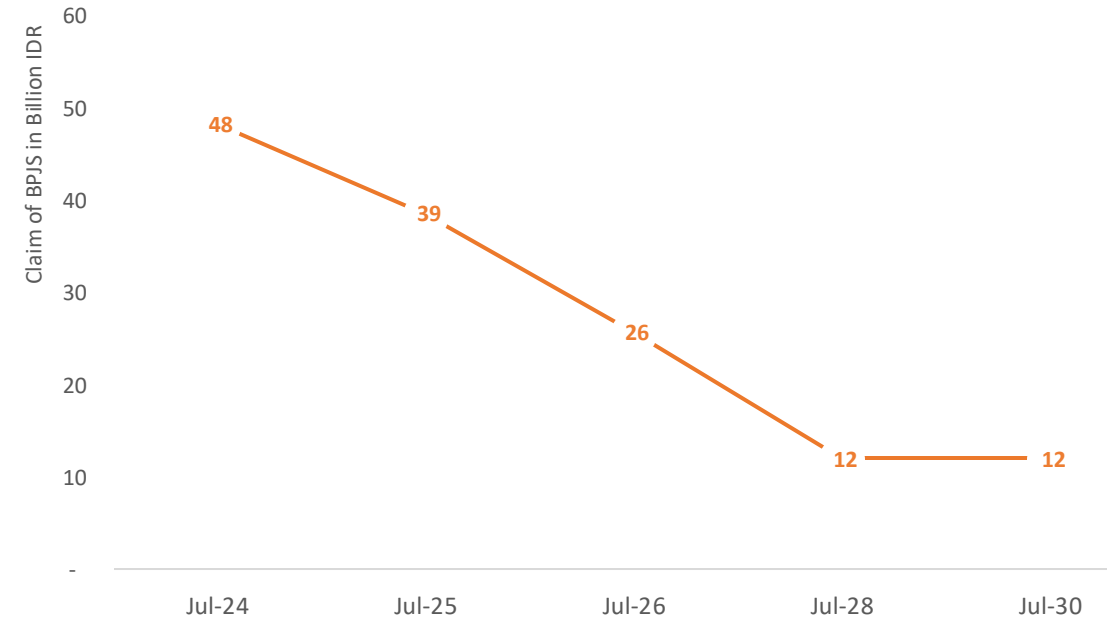


EURO 4 DIESEL SCENARIO AND THE IMPACT TO PNEUMONIA

ESTIMATED C.O.P.D. CASES AFTER IMPLEMENTATION OF EURO 4 FUEL STANDARD 10%, 34%, 66%, 100% IN JAKARTA 2024-2030 (84% REDUCTION)

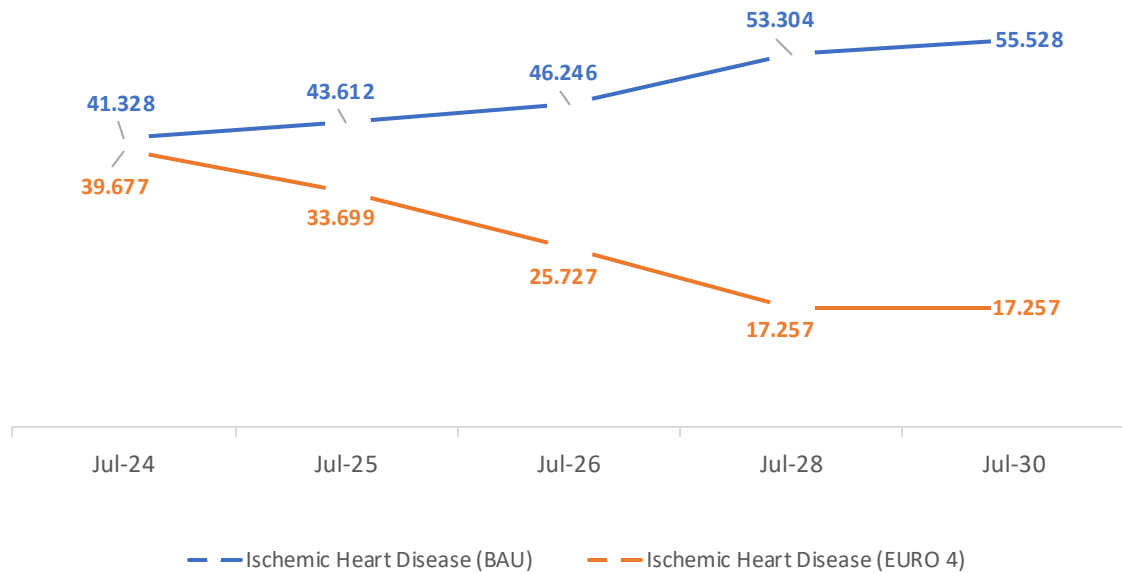


IMPLEMENTATION OF EURO 4 FUEL SCENARIO AND COST OF TREATMENT BPJS'S CLAIM FOR C.O.P.D. (IDR 36 BILLION REDUCTION)

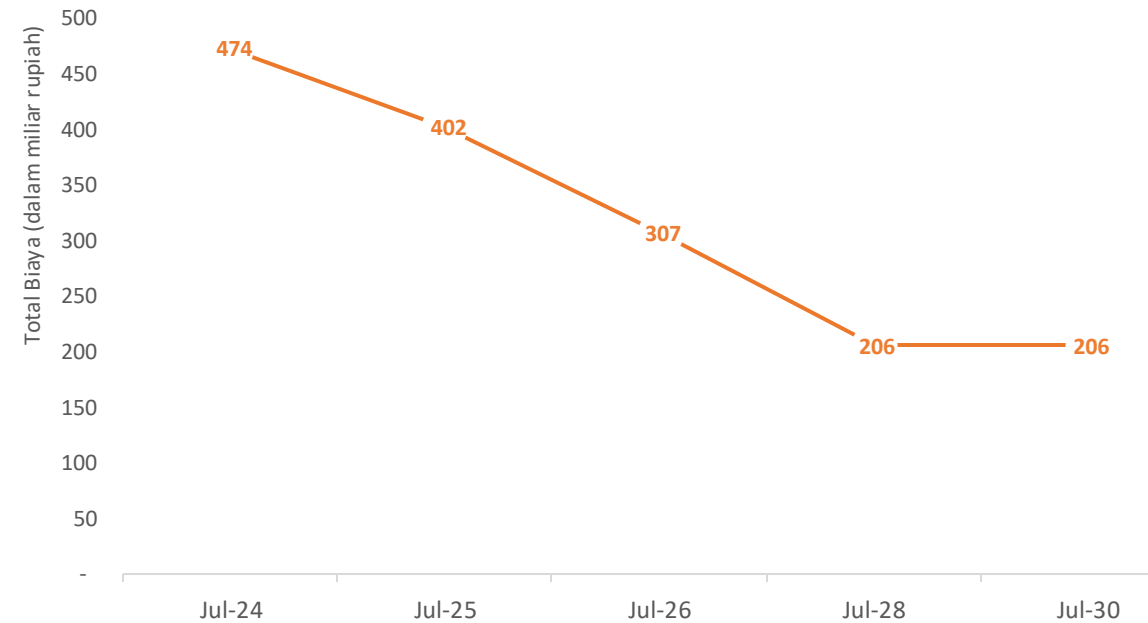


EURO 4 DIESEL SCENARIO AND THE IMPACT TO CHRONIC OBSTRUCTIVE PULMONARY DISEASE

ESTIMATED ISCHEMIC HEART DISEASE CASES BASED ON EURO 4 FUEL SCENARIO 10%, 34%, 66%, 100% IN JAKARTA 2024-2030 (69% REDUCTION)



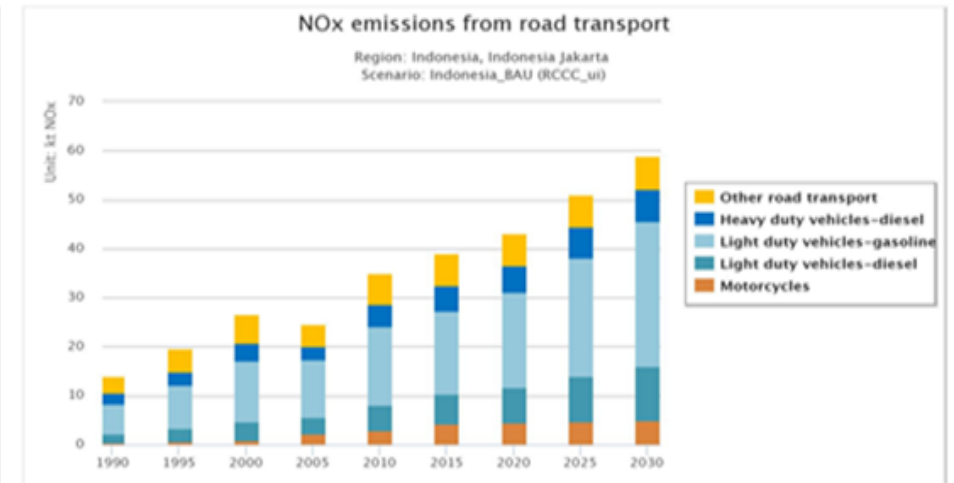
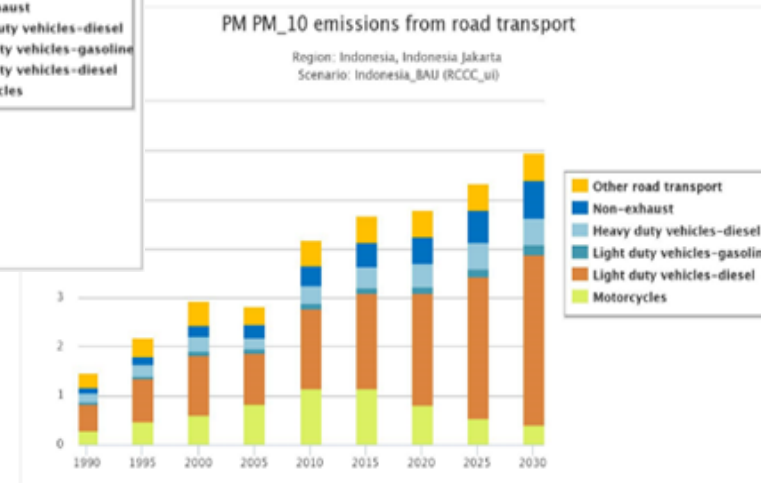
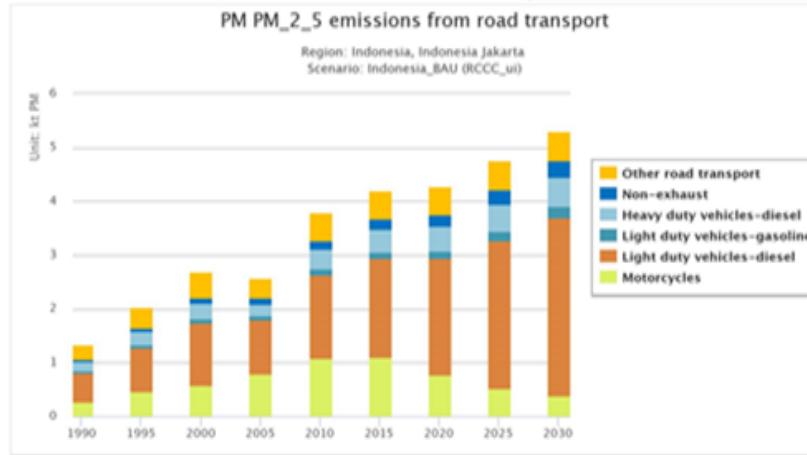
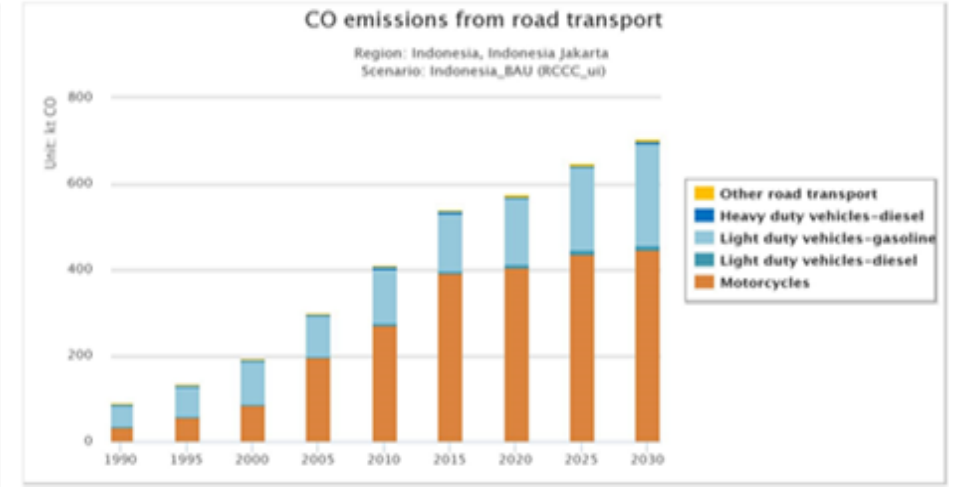
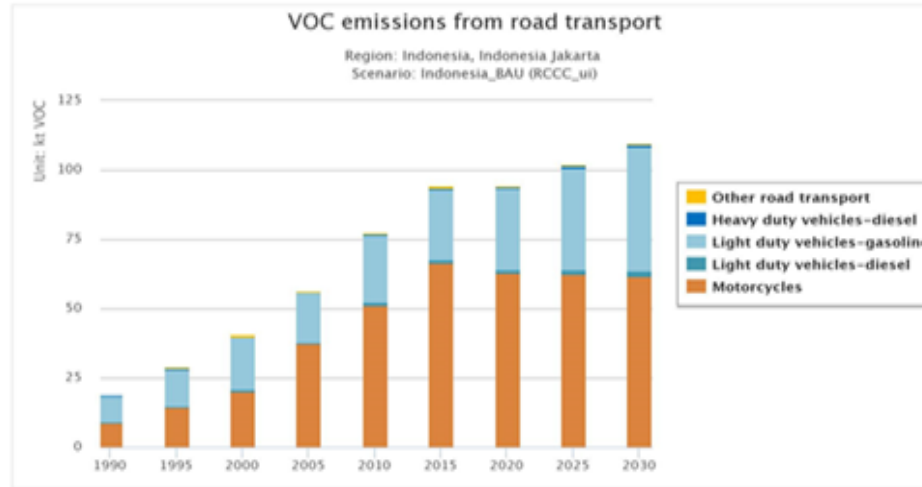
IMPLEMENTATION OF EURO 4 FUEL SCENARIO AND COST OF TREATMENT BPJS'S CLAIM IN JAKARTA (IDR 268 BILLION REDUCTION)



EURO 4 DIESEL SCENARIO AND THE IMPACT TO ISCHEMIC HEART DISEASE

Air quality transportation sector's projection in Indonesia

RCCC-UI, IIASA, Toyota Clean Air Project 2017



CONCLUSION

- Improving fuel quality by reducing sulfur content to 50 ppm (EURO 4 Standard) brings significant health benefits. Lower sulfur emissions reduce air pollution, a major cause of respiratory diseases like pneumonia and Chronic Obstructive Pulmonary Disease (COPD), as well as ischemic heart disease.
- Cleaner air lowers the risk of these conditions, leading to fewer hospitalizations and healthcare costs. Treatment for pneumonia, COPD, and heart disease can be expensive, with long-term care and medications adding financial strain.
- By promoting cleaner fuel, we not only protect public health but also reduce the economic burden associated with treating pollution-related diseases.

Healthier air means healthier lives

THANK YOU