

Assessing the Impact of Battery Electric Vehicles (BEVs) Adoption on Air Quality and Public Health in Indonesia

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Background

- **Vehicle registration data over the past five years** show that motorcycles, passenger cars, and buses **experienced significant growth**, with each category increasing by approximately 4% (BPS, 2025).
- **The transportation sector identify as one of the largest contributors to air pollution emissions** in urban areas across Indonesia, especially PM_{2.5} (Lestari, 2025; Santoso, 2020).
- **PM_{2.5} is strongly associated with adverse health outcomes**, including increased risks of cardiovascular disease, respiratory disorders, and premature mortality
- In 2021, an estimated **221.600 premature deaths in Indonesia were caused by outdoor air pollutants** (GBD, 2021).

Study Objectives

- **Accelerating the adoption of battery electric vehicles (BEVs) can serve as a key strategy in advancing transport decarbonization** in Indonesia.
- However, **empirical evidence** quantifying the impacts of BEV adoption on air quality and public health in the Indonesian context **remains limited**.
- In response to this gap, **Clean Air Asia, supported by ViriyaENB, analyzed the impacts of electric vehicle adoption on air quality and public health in Indonesia.**

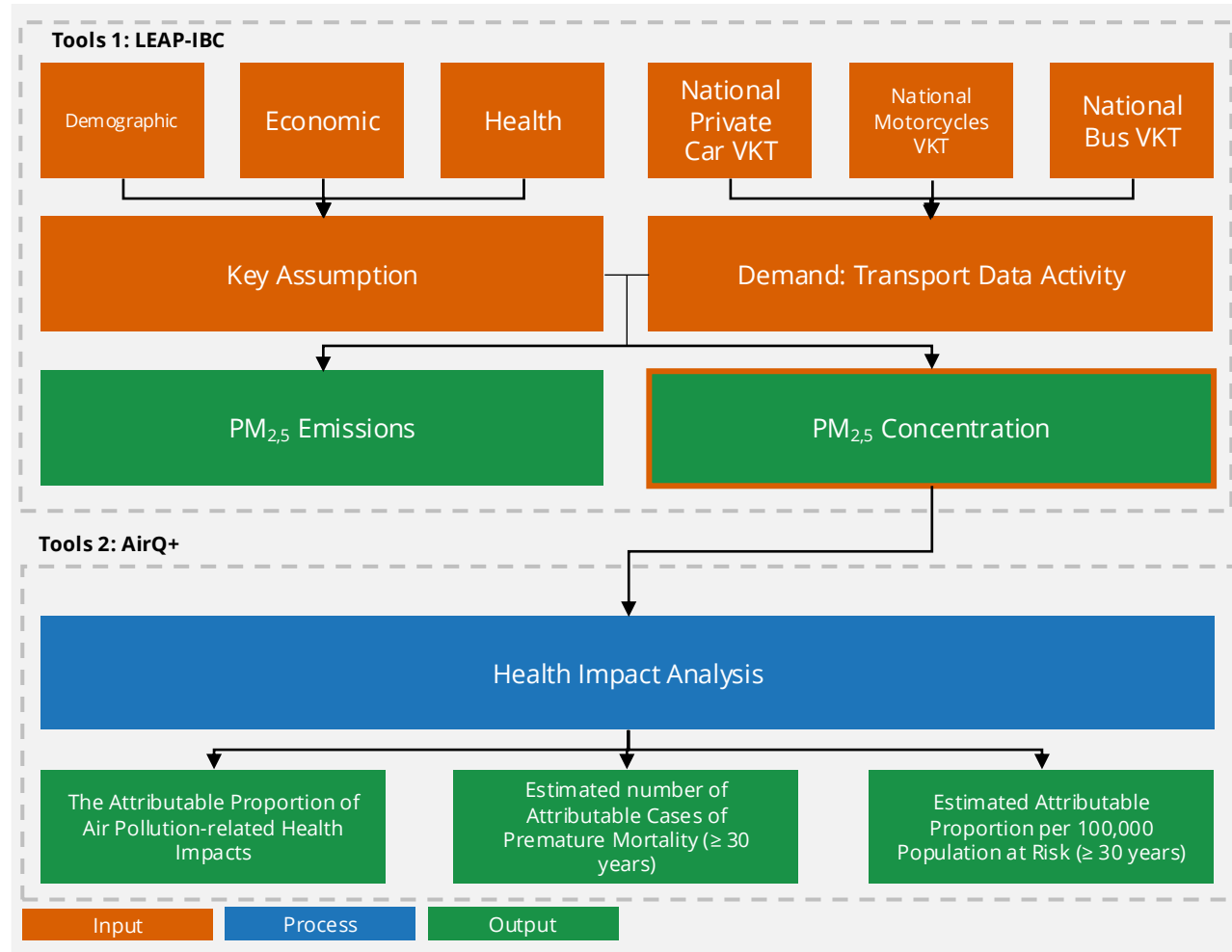


Pict 1. Published Report



Pict 2. Published Paper

Methodology



Pict 3. Logical Framework

- This study uses **LEAP IBC and AirQ+** to estimate impacts on air quality and public health.
- Four scenarios were developed** based on Indonesia's national policy targets and transport studies, differentiated by their level of ambition.

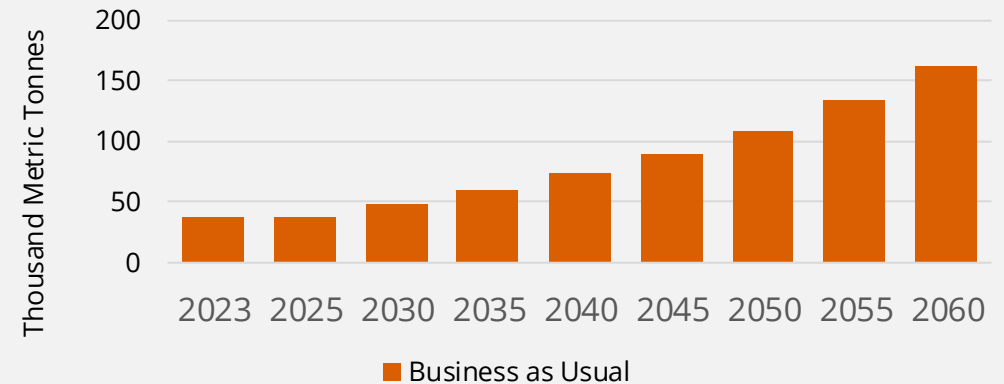
Table 1. Scenario Interventions

Scenario Intervention	BEV Target		
	Motorcycles	Private Cars	Bus
Business as Usual (BaU)	Based on vehicle growth from 2019 – 2023 (with no intervention)		
Scenario I (pessimistic)	2030: 2%; 2060: 29%	2030: 2%; 2060: 32%	2030: 2%; 2060: 23%
Scenario II (moderate)	2030: 11%; 2060: 100%	2030: 7%; 2060: 98%	2030: 4%; 2060: 95%
Scenario III (ambitious)	2030: 7%; 2037: 100%	2030: 8%; 2040: 100%;	2060: 100%

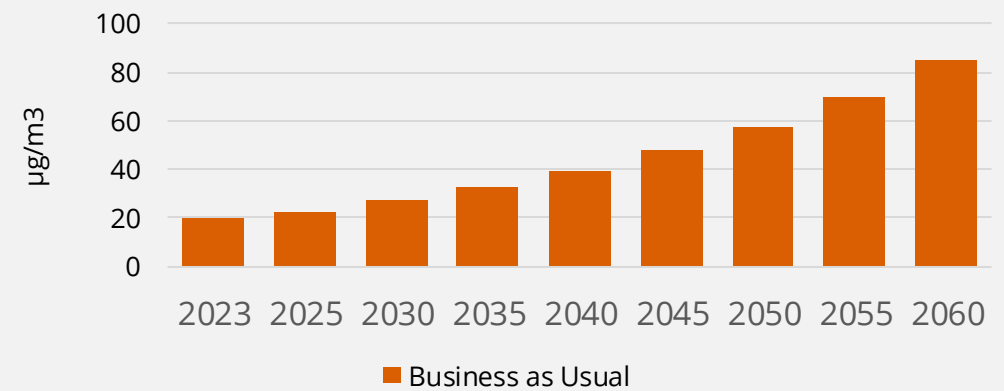
Emissions and Concentrations Continue to Rise Under BaU Scenario

- **Without policy interventions, emissions and ambient air pollution are expected to continue rising.**
- The study results indicate that **by 2060**, total emission loads could rise to more than **160,000 metric tons from the transport sector** alone.
- **PM_{2.5} concentrations** attributable to transportation sector are projected to reach **85 µg/m³ in 2060**, far exceeding the World Health Organization (WHO) guideline levels.
- This trajectory reflects the direct consequences of maintaining the BaU scenario: vehicle growth continues to rise, while emission control measures efforts remain insufficient to curb the pace of air pollution.

Pict 4. Business as Usual PM_{2.5} Emissions



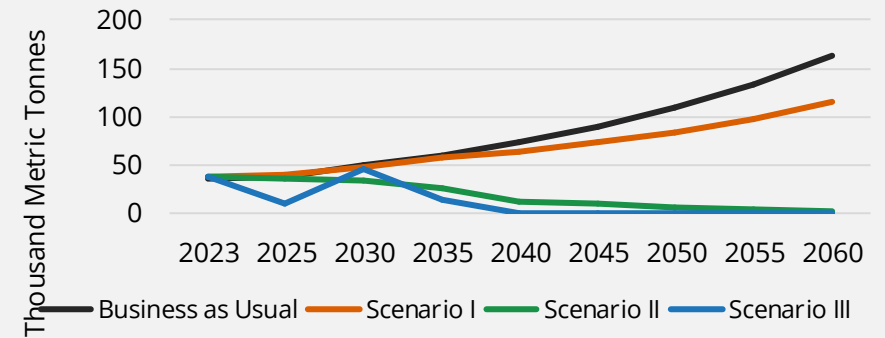
Pict 5. Business as Usual PM_{2.5} Concentration



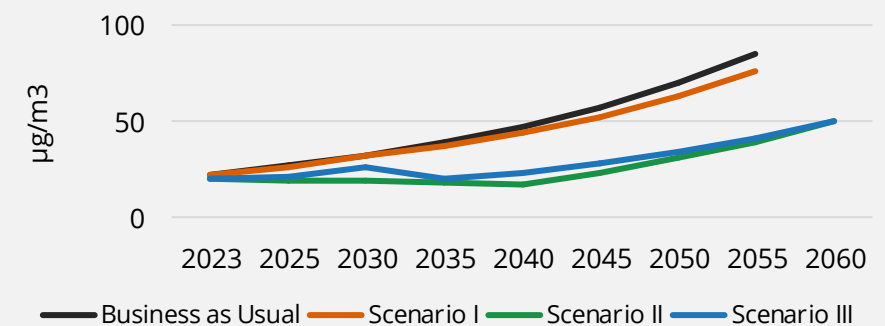
BEV Adoption Scenarios Significantly Reduce PM_{2.5} Emissions and Concentrations

- Compared to BaU, **BEV adoption significantly reduces PM_{2.5} emissions and concentrations across all intervention scenarios**
- **Scenarios II and III result in substantially greater reductions in PM_{2.5} concentrations, approximately 40–41% lower than the Business-as-Usual (BaU) scenario by 2060, bringing projected concentrations down to around 50 µg/m³.**
- **The rebound in concentrations observed after 2045 under Scenarios II and III reflects a shift in emission burdens to the power generation sector.** In the Indonesian context, electricity supply remains largely dominated by fossil fuel-based power plants. This dynamic is captured in the well-to-wheel accounting approach applied in the LEAP-IBC modeling framework.

Pict 6. PM_{2.5} Emission

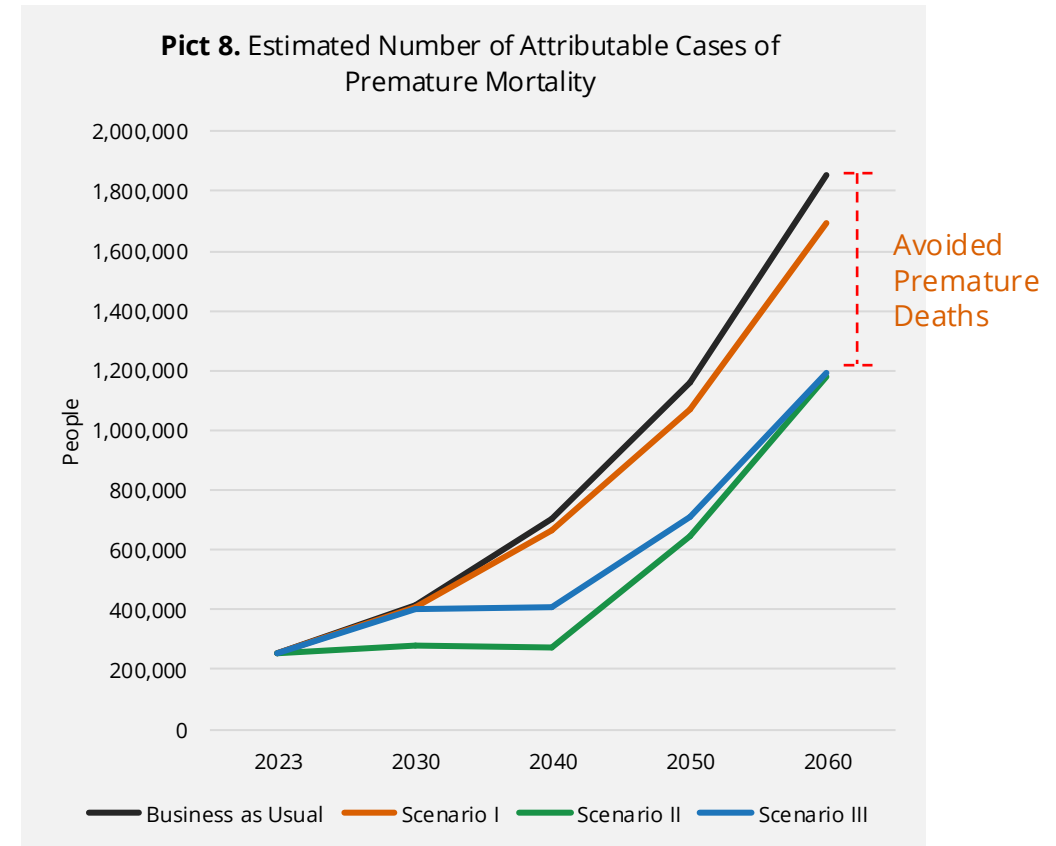


Pict 7. PM_{2.5} Concentration



BEV Adoption Could Prevent a Substantial Number of Premature Deaths

- **Without policy intervention**, the health burden from air pollution is projected to rise sharply. **By 2060, premature deaths attributable to PM_{2.5} exposure in Indonesia could reach 1.8 million annually.**
- Under **Scenario I**, the figure is slightly lower at **1.69 million deaths**. More substantial reductions are observed under **Scenarios II and III**, with projected premature deaths declining to **1.18 million and 1.19 million**, respectively.
- Accelerating the adoption of battery electric vehicles (BEVs) significantly reduces air pollution exposure from the transport sector. Under **Scenario III**, up to **36% of premature deaths could be avoided**, equivalent to approximately **700,000 lives saved in 2060 alone**.
- These health benefits arise because **electric vehicles produce zero tailpipe emissions**, which are currently a major source of urban PM_{2.5} pollution.



Conclusions

- This study demonstrates that **the adoption of battery electric vehicles (BEVs) has significant potential to improve air quality and reduce adverse health impacts.**
- An ambitious scenario yields the greatest benefits, including an estimated **40% reduction in PM_{2.5} concentrations** and the potential prevention of nearly **700,000 premature deaths in 2060.**
- **However, to fully realize these benefits, transport electrification must be accompanied by a fast transition to cleaner power generation.**



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Thank you

For any questions, feel free to react at
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