ITDP Institute for Transportation & Development Policy

# GHG Reduction Estimation

# Supporting Jakarta's Transition to E-Mobility

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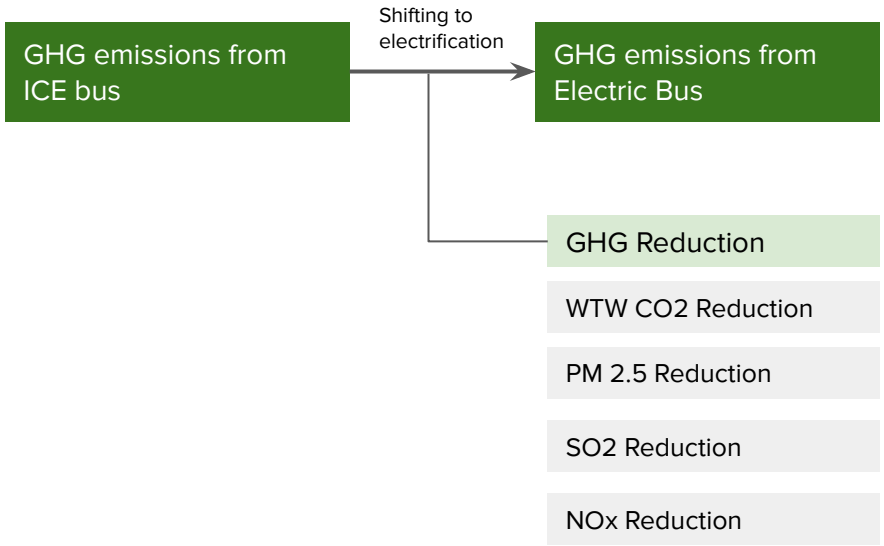
## Outline

- Methodology
- Data Input
- Carbon Intensity
- Findings
- Summary

# Methodology

## Main Approach



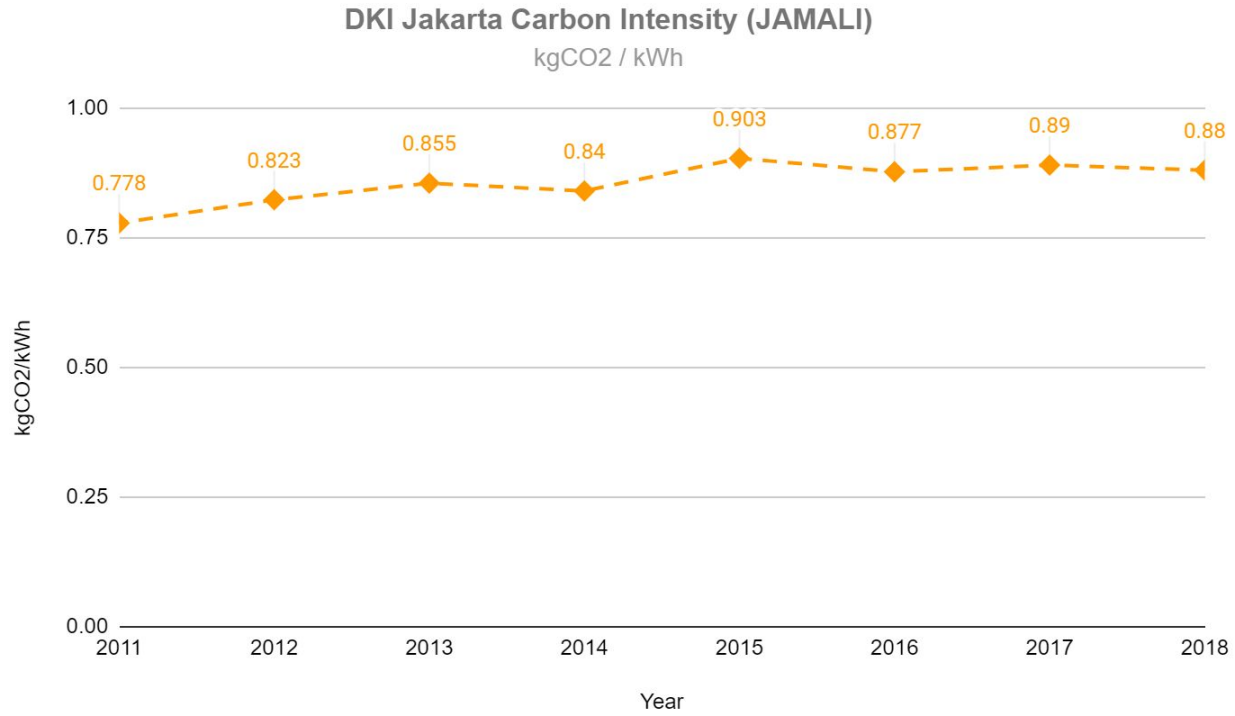

## Basic Equation (IPCC Guidelines)

Emissions Reduction = (V.K.T. ICE bus x EF ICE bus) - (V.K.T. E-Bus x EC x EF E-Bus)

Where:

$VKT_{ICE\ bus}$ : ICE bus kilometres travelled (km)
$EF_{ICE\ bus}$ : emissions factor for ICE bus (kgCO2eq/km)
$VKT_{E\text{-}bus}$ : ICE bus kilometres travelled (km)
EC : energy consumption (kWh/km)
$EF_{E\text{-}bus}$ : emissions factor for ICE bus (kgCO2eq/kWh)

## Carbon Intensity DKI Jakarta 2011 - 2018



# Data Input

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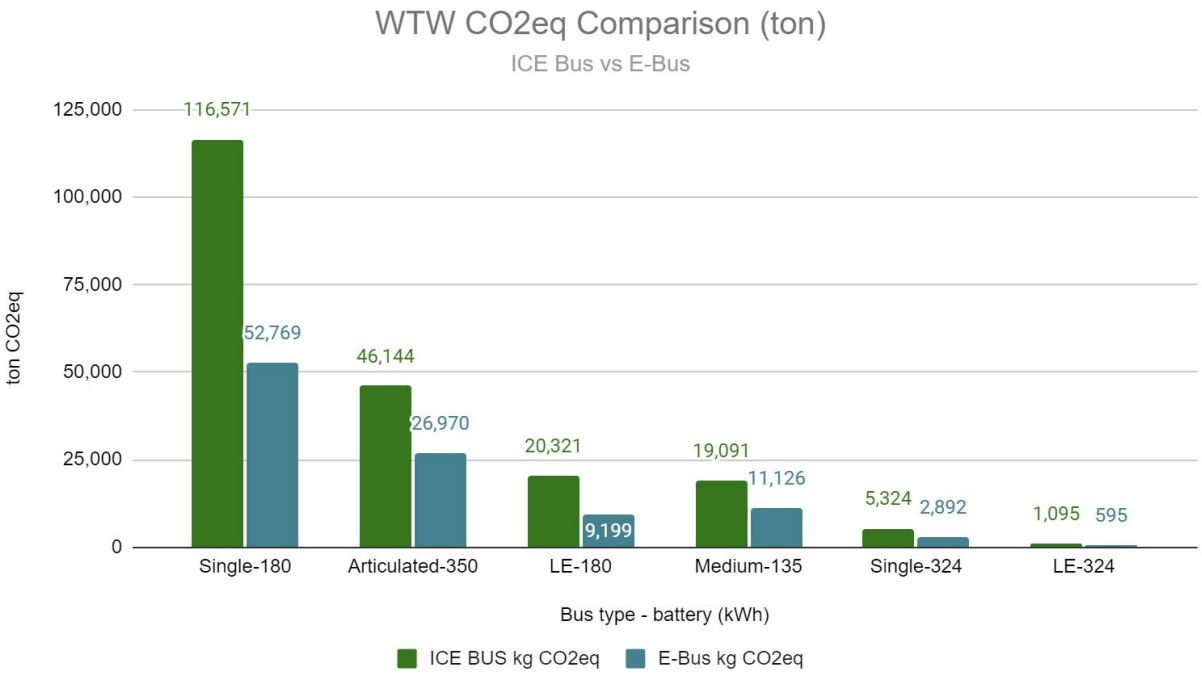
## Emission Factor

| Parameter | ICE Buses | | | Electric Bus | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|
| | Single & LE Bus | Medium Bus | Articulated Bus (CNG) | Single-180 | Medium-135 | Articulated-350 | Single-324 | LE-180 | LE-324 | |
| WTW CO2 Emissions Factor (kg CO2eq/vkm) | 1.94 | 1.51 | 3.46 | 0.88* | 0.88* | 2.02* | 1.05* | 0.88* | 1.05* | COPERT Model<br>*Based on Jakarta Carbon Intensity, converted with energy consumption |
| $PM_{2.5}$ (g/km) | 0.63 | 0.15 | 0.01 | 0 | 0 | 0 | 0 | 0 | 0 | Transjakarta data , taken from Grutter Consulting, 2018 |
| $SO_2$ (g/km) | 0.4 | 0.14* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Grutter Consulting, 2018<br>* Ministry of Environment and Forestry Regulation no 12/2010 |
| $NO_x$ (g/km) | 14 | 4.7 | 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | Grutter Consulting, 2018 |

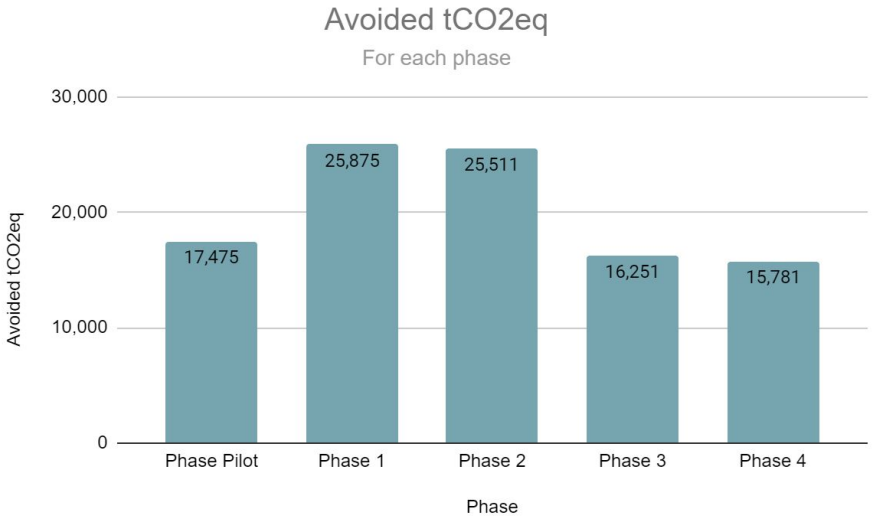
# Findings and Result

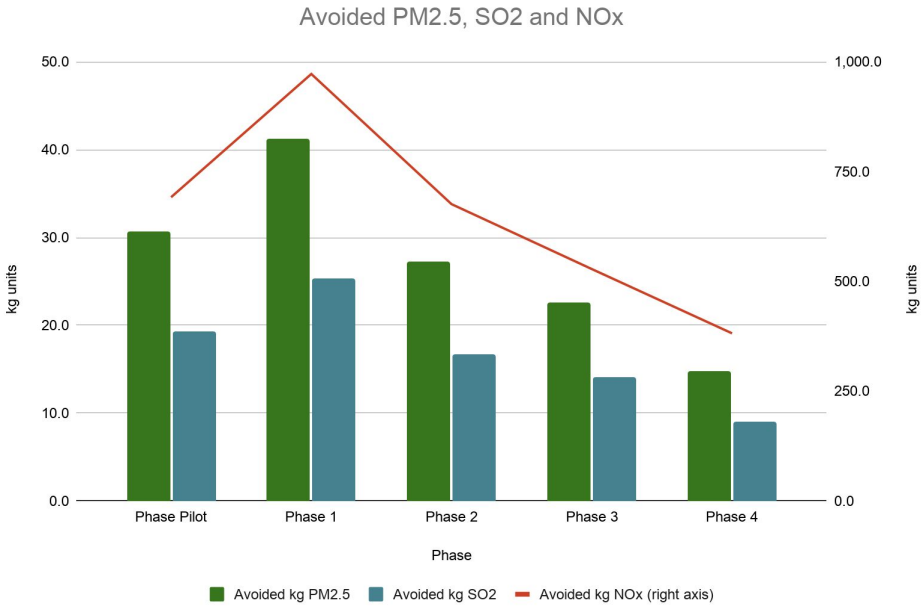



Based on the chosen bus typology, the largest avoided CO2 emission was found from the operation of **single bus with medium battery size (53.7%)** and the lowest value received from the operation of **articulated bus with 350 kWh battery (41%)**

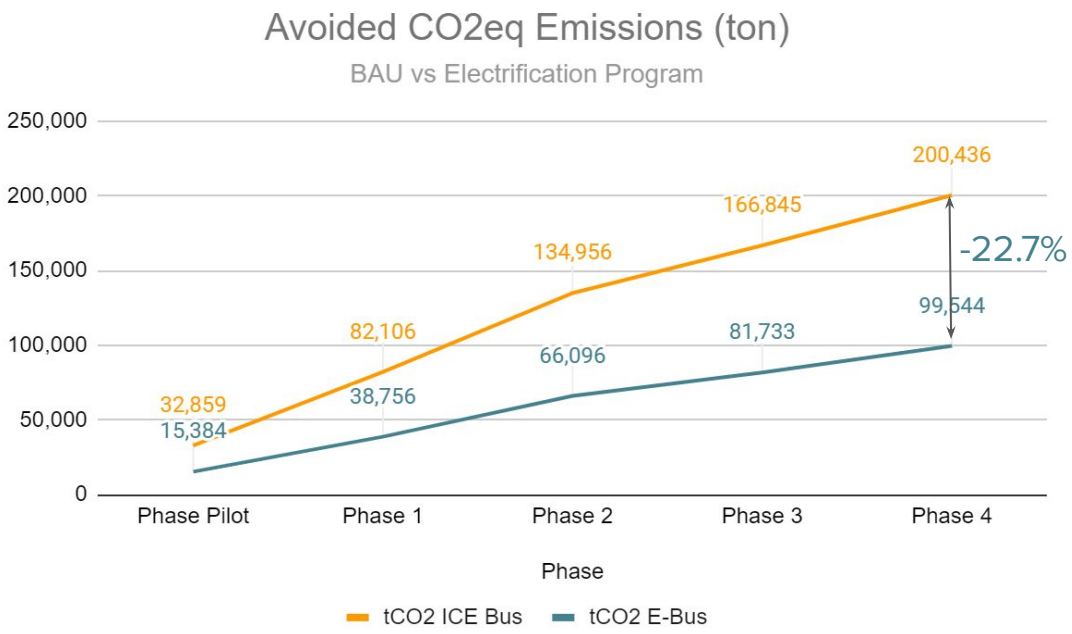
# Findings and Result

## Avoided CO2, PM2.5, SO2, and NOx



## Conclusion




- Based on the energy consumption achieved by each bus type, it was found the largest CO2 emissions reduction appeared in the shift to medium bus with medium battery size (135 kWh)
- Given carbon intensity condition in Jakarta, the deployment of electric bus in public transport system could reduce around 22% of total CO2 emissions from BAU option
- Total avoided emissions for all implementation phase:
  - CO2 eq : 100,892 tCO2eq
  - PM 2.5 : 137 kg
  - SO2 : 84,4 kg
  - NOx : 3,251 kg