Fuel economy development and several researches for E-mobility promotion in Vietnam

University of Transport Technology| Vu Ngoc Khiem, Assoc. prof. PhD.  
Research Group on Climate Change Responding - UTT
June 13-15, 2022 | Shifting to Efficient and Zero Emissions Vehicles in the Global South  
Nairobi, Kenya
Fuel economy development
and several researches for E-mobility promotion in Vietnam

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PRESENTATION OUTLINE:

Part 1: Vietnam Transport and Air Quality

• Transport Growth in Vietnam
• Road transport and vehicle growth in Vietnam
• Air pollution and GHG emissions from Transport

Part 2: Fuel economy development and several researches for E-mobility promotion in Vietnam

• Fuel Economy development in transition to e-mobility
• Electric mobility researches
• Recommendation on GFEI development
Road transport plays a key role in passenger and freight transport in Vietnam (Vietnam Statistical Yearbook 2020).

Road passenger transport accounts for about 93% of total trips, followed by water, air and rail transport with about 6%, <1%, and 0.1% respectively of total trips.

Road freight transport accounts for more than 80% of the total volume, followed by water transport with about 15%.
The average growth rate of road passenger and freight transport is 8.6% and 9.6%, respectively. Thus, the total number of road vehicles has also increased rapidly.

As of 2020, Vietnam has about 69.19 million registered vehicles, including 65.27 million motorbikes (average annual growth of 6.9% since 2010), 2.25 million cars (increase 13.6%) and 1.36 million trucks (increase 8.5%).
# ROAD VEHICLE GROWTH IN VIETNAM

## Personal Vehicles

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorbikes</td>
<td><img src="image1.png" alt="Motorbikes" /></td>
</tr>
<tr>
<td>Cars</td>
<td><img src="image2.png" alt="Cars" /></td>
</tr>
<tr>
<td>E-mopes</td>
<td><img src="image3.png" alt="E-mopes" /></td>
</tr>
<tr>
<td>E-scooters</td>
<td><img src="image4.png" alt="E-scooters" /></td>
</tr>
</tbody>
</table>

## Freight Transport

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipping motorbikes</td>
<td><img src="image5.png" alt="Shipping motorbikes" /></td>
</tr>
<tr>
<td>3-wheelers</td>
<td><img src="image6.png" alt="3-wheelers" /></td>
</tr>
<tr>
<td>Light duty trucks (GVM ≤ 5,000 Kg)</td>
<td><img src="image7.png" alt="Light duty trucks" /></td>
</tr>
<tr>
<td>Light duty trucks (5,000 Kg &lt; GVM ≤ 10,000 Kg)</td>
<td><img src="image8.png" alt="Light duty trucks" /></td>
</tr>
<tr>
<td>Trucks (10,000 Kg &lt; GVM ≤ 24,000 Kg)</td>
<td><img src="image9.png" alt="Trucks" /></td>
</tr>
<tr>
<td>Heavy duty trucks (24,000 Kg &lt; GVM ≤ 45,000 Kg)</td>
<td><img src="image10.png" alt="Heavy duty trucks" /></td>
</tr>
<tr>
<td>Long haul trucks (GVM ≥ 45,000 Kg)</td>
<td><img src="image11.png" alt="Long haul trucks" /></td>
</tr>
<tr>
<td>Container Truck</td>
<td><img src="image12.png" alt="Container Truck" /></td>
</tr>
</tbody>
</table>

## Vận tải công cộng

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor taxis</td>
<td><img src="image13.png" alt="Motor taxis" /></td>
</tr>
<tr>
<td>Taxis</td>
<td><img src="image14.png" alt="Taxis" /></td>
</tr>
<tr>
<td>Small coaches (10-16 seats)</td>
<td><img src="image15.png" alt="Small coaches" /></td>
</tr>
<tr>
<td>Coaches (17-55 seats)</td>
<td><img src="image16.png" alt="Coaches" /></td>
</tr>
<tr>
<td>Urban buses</td>
<td><img src="image17.png" alt="Urban buses" /></td>
</tr>
<tr>
<td>Tourist electric buses</td>
<td><img src="image18.png" alt="Tourist electric buses" /></td>
</tr>
<tr>
<td>Vinfast e-buses</td>
<td><img src="image19.png" alt="Vinfast e-buses" /></td>
</tr>
<tr>
<td>Urban trans</td>
<td><img src="image20.png" alt="Urban trans" /></td>
</tr>
</tbody>
</table>
According to WHO, from 2008 to 2017, Hanoi was in the list of 500 cities with the highest annual average concentration of PM2.5 dust and ranked at 214 (48 μg/m3).

PM2.5 fine dust particles are able to penetrate deep into the lungs.
• **In 2014:** ~ 33.2 million tons of CO\(_2\)eq
  - Road transport: the highest (~26.4 million tons of CO\(_2\)eq)
• **Average annual growth rate of GHG emissions:**
  - **From transport:** 6 – 7% (during 2014-2030)\(^{(2)}\)
• **In 2030:** 89.1 Million tons of CO\(_2\)eq from Transport (*forecast*)
  - Road transport: the highest (~71.7 million tons of CO\(_2\)eq)
Vietnam committed to reduce GHG emissions by 25% by 2030 with international support (Paris Agreement signed in 2015).

This contribution was raised to 27% in the updated Nationally Determined Contribution (NDC) in 2020.

The Government of Vietnam has made a new commitment to achieve net zero emissions by 2050 (Glasgow Climate Agreement - COP 26 in 2021).
SOLUTIONS FOR BETTER AIR QUALITY

- Training and raising awareness
- Shifting transportation modals
- Infrastructure improvement

Solutions and Policies to reduce pollutants and GHGs from transportation activities

- Vehicle Improvement
- Public transport development
- Cleaner fuels
Part 2
Fuel economy development and several researches for E-mobility promotion in Vietnam
UTT RESEARCH GROUP ON CLIMATE CHANGE RESPONDING
LIST OF COMPLETED PROJECTS:


2. Proposing to raise emission standards for in-use vehicles and imported used vehicles (Results: On March 28, 2019, the Prime Minister issued Decision No. 16/2019 / QĐ-TTg);


4. Pilot manufacture the HHO gas generating device added to the intake manifold of the internal combustion engine to improve the quality of the combustion process and reduce the toxicity of the exhaust gas to the environment, 2017.

5. Application of EGR and DPF filters to reduce the emissions of harmful substances in the diesel engine exhaust gas installed on small and medium sized ships, 2017.


8. Renovating a car used popularly in Vietnam into a hybrid electric car, 2013.


Reports have been delivered to UNEP under the project **Mainstreaming Electric Mobility (focusing on 2-wheelers)** in Vietnam:

1.1. National Project Launch Workshop Report
1.2. National Baseline and Pilot Design Dissemination Workshop Report
1.3. Advisory Group and Stakeholder Consultations Report


2.2. Report on the electricity demand baseline and trends given various electric mobility uptake scenarios.

2.3. Report on the local manufacturing potential for electric vehicles and their components as well as industry financing requirements

2.4. Report on the barriers for uptake of electric mobility in Vietnam with recommendations for mitigation.

3.1. Pilot Project Design Report with Awareness Raising Strategy
3.2. Final Technical Studies and Reports
MAINTREAMING ELECTRIC MOBILITY IN VIET NAM (Focusing on 2-Wheelers)

Fuel Economy development in transition to electric mobility in Vietnam
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO₂ Emission


Number of light-duty passenger vehicles sold from 2010 to 2017 [VAMA]

Market share of major manufacturers in Vietnam, [VAMA]
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO₂ Emission

2.1.1. Current status of newly registered motorcycles in Vietnam (cont)

Number of motorcycles sold in Vietnam, [VAMM]

Market share of motorcycle manufacturers in Vietnam
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO$_2$ Emission

2.1.1. Current status of newly registered heavy-duty vehicles

Number of heavy-duty in Vietnam

Number of passenger vehicle in Vietnam
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO₂ Emission

2.1.2. Data Collection

- Light-duty passenger cars: selected 49 popular brands produced by 7 manufacturers with the largest market share in Vietnam
- Motorcycle: support from the Vietnam Association of Motorcycle Manufacturers (VAMM), sales data on 25 most popular motorcycle brands were collected
- Fuel consumption data has been collected according to the following criteria for the years:
  1. Vehicle make (e.g. Toyota, Hyundai, Mazda..)
  2. Vehicle model (e.g. Corolla, Vios, Honda City...)
  3. Model production year (e.g. 2010, 2011,2012....)
  4. Engine displacement (e.g. 1,400cc)
  5. Fuel type (e.g. gasoline)
  6. Rated fuel economy (Lge/100km) from NEDC test cycle basis.
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO₂ Emission

2.1.3. GFEI for light-duty passenger cars

FC values of vehicles moving in the city, outside the city and in mixed cycle

FC index per vehicle type

FC values of vehicles moving in the city, outside the city and in mixed cycle
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO₂ Emission

2.1.3. GFEI for light-duty passenger cars (cont)

FC index per cylinder capacity

Results of the FC index calculation by weight
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO₂ Emission

2.1.3. FC for motorcycles

Calculation results of FC for motorcycles by cylinder capacity

Calculation results of FC for motorcycles by weight
2.1. Calculation Global Fuel Economy Initiative (GFEI) and CO₂ Emission

2.1.4. GFEI for heavy-duty trucks and passenger vehicles

Calculation results of FC for trucks

Calculation results of FC for passenger vehicles
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO₂ Emission

2.1.5. CO₂ emissions

Calculation of the average CO₂ emissions from light-duty passenger cars

Calculation results of average motorcycles CO₂ emissions
2.1. Calculation Global Fuel Economy Initiative (GFEI) And CO₂ Emission

2.1.5. CO₂ emissions (cont)

Calculation of the average CO₂ emissions from truck and passenger cars
Calculation of national vehicle fleet fuel economy in Vietnam

Supported by UNEP

2010-2017

2010-2017

2010-2019

2010-2019

Supported by GIZ (in progress)

2016-2020
Researches for E-mobility promotion in Vietnam
Urban mobility and sustainable electrification in large urban areas in developing and emerging economies (Solutionplus)
**Urban mobility and sustainable electrification in large urban areas in developing and emerging economies**

<table>
<thead>
<tr>
<th>Work Package</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP 1</td>
<td>Toolbox for efficient electric mobility solutions, an assessment framework for evaluation, potential impacts of e-mobility solutions on society and the environment.</td>
</tr>
<tr>
<td>WP 2</td>
<td>Training courses and other activities to boost the capabilities of local and national policy makers, practitioners, entrepreneurs, and operators to develop, implement and operate innovative urban electric mobility innovations</td>
</tr>
<tr>
<td>WP 3</td>
<td>Fostering partnerships to test local innovations and business concepts in the context of the demonstration actions and provide business models (on vehicles, operations and integration) that can then be taken up by partnerships.</td>
</tr>
<tr>
<td>WP 4</td>
<td>Implementing demo project to test innovative e-mobility solutions in different socio-economic and policy environments, engage stakeholders and users to enable long-term sustainability and develop e-mobility solutions with a high level of replicability</td>
</tr>
<tr>
<td>WP 5</td>
<td>Developing concepts and implementation plans for scaled-up e-mobility projects, prefeasibility studies to seek for additional grant and/or non-grant funding, facilitate close cooperation with potential funding organizations</td>
</tr>
<tr>
<td>WP 6</td>
<td>Exploit and replicate the innovations and partnerships initiated by this project, disseminate and communicate the activities, results and benefits of the project</td>
</tr>
</tbody>
</table>
Component in Vietnam: Last mile connectivity by two-wheel electric scooters for public transport in Hanoi

Station A: BRT Van Khe
Parking lot: Anland Complex

Station B: Aeon mall Hadong
Parking lot: Aeon mall Hadong

E-V sharing for last-mile connectivity

Phase 1:
Fleet: 50 e-scooters (Vinfast - Ludo) and 10 e-bikes (QiQ)
Target users: BRT guests to Aeonmall
Timeslot of operation: From 7:00 am to 9:00 pm

2 km

Vinfast - Ludo
QiQ e-bike
Component in Vietnam: Last mile connectivity by two-wheel electric scooters for public transport in Hanoi

Charging infrastructure

Demo route

V-share App
STUDY FOR THE DEVELOPMENT OF ELECTRIC 2 WHEELERS IN HANOI
supported by AFD

➢ Develop parking lots for electric two wheelers;
➢ Picking up guests at the stations;
➢ Last mile connectivity

Design of on-street parking for e bikes

Parking lots at BRT and Metro station in Hanoi
Conditions of complementariness between electric 2 wheelers and public transport in Hanoi

Recommendation for developing electric 2 wheelers and public transport intermodal
Study on the standards for electric vehicle battery swap system following the IEC standards:


Infrastructures for electric vehicles installing rapidly in Vietnam but lacking its relevance standards.
APPLICATION OF FC AND FA CALCULATION RESULTS

- Develop a transition roadmap to electric vehicles

- Application of FC and FA calculation results for energy labeling
Develop a transition roadmap to electric vehicles

Total CO2 emissions in the years are calculated using the following formula:
\[ \text{CO2} = 365 \times x1 \times (x2 \times C1 + x3 \times C2) \]
In which:
- \( x1 \): Average distance traveled in a day
- \( x2 \) and \( x3 \): Number of ICE two wheelers to electric two wheelers
- \( C1 \) and \( C2 \): Emissions from ICE two wheelers to electric two wheelers

- Collect and calculate the average travel distance of two-wheelers in Vietnam
- Calculation of baseline and CO2 emissions (g/km) of ICE two wheelers
- Calculate CO2 emissions (g/km) from electric vehicles based on: the amount of electricity consumed for a single charge of an electric vehicle; the distance traveled per charge of an electric vehicle and the emission factor from the electricity industry
- Proposing a roadmap for transitioning to electric mobility in Vietnam based on achieving net zero emissions by 2050
Application of FC and FA calculation results for energy labeling

- Labeling for vehicles over 9 seats and trucks

- Compulsory regulations on fuel consumption for each type of vehicle
THANK YOU FOR YOUR ATTENTION!

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