2- and 3-wheelers in Southeast Asia

Opportunities for affordable, clean, and efficient mobility

Jacob Teter, IEA
Jakarta, 16 July 2018

#energyefficientworld
Contents

• The utility, ubiquity, and economic benefits of 2&3-wheelers
• Energy consumption and emissions
• Improvements in fuels and vehicles in recent decades
• Potential benefits from fuel economy or electrification
• Efficient transport in current and future megacities
2- & 3-wheelers: fast, convenient, affordable motorized mobility

Motorcycles per 1000 people, 2016

Source: IEA Mobility Model, May 2018

2- & 3-wheelers provide affordable mobility throughout Asia
2- & 3-wheelers: the dominant vehicle type in Southeast Asia

Indonesia’s 2- & 3-wheeler fleet has grown 10-fold over the past two decades

Motorcycles per 1000 people, 2016

Source: IEA Mobility Model, May 2018
2- & 3-wheelers: the dominant vehicle type in Southeast Asia

This pattern of a growing 2- & 3-wheeler fleet with rising incomes is mirrored in Vietnam

Motorcycles per 1000 people, 2016

Source: IEA Mobility Model, May 2018
2- & 3-wheelers: the dominant vehicle type in Southeast Asia

The 2&3-wheeler fleet in the Philippines grew 7.5 fold, while the economy grew by a factor of 2.5

Motorcycles per 1000 people, 2016
Source: IEA Mobility Model, May 2018
2- & 3-wheelers: the dominant vehicle type, also in China

China’s fleet is still mostly composed of 2- & 3-wheelers

Motorcycles per 1000 people, 2016
Source: IEA Mobility Model, May 2018
2- & 3-wheelers: enduring utility, even in developed economies

- Japan’s fleet composition trends suggest that 2&3-wheelers might be ‘just a phase’ of development
- But France’s trends suggest the enduring utility of this vehicle type in certain contexts
Economic activity

Vehicle sales in Indonesia

Motorcycle production, 2015

Source: IEA Mobility Model, May 2018

Domestic assembly and manufacturing of 2- & 3-wheelers are major industries across ASEAN countries
Road Energy Consumption in Indonesia

- 2&3-wheelers consume 27% of road transport fuels in Indonesia
- Shares are similar across ASEAN: 21% in Vietnam, 10% in Thailand, 8% in the Philippines
Fuel economy standards for 2- & 3-wheelers in China

<table>
<thead>
<tr>
<th>Engine Size (cc)</th>
<th>China two-wheelers l/100km</th>
<th>China three-wheelers l/100 km</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤50 (mopeds)</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>&gt;50-100</td>
<td>2.3</td>
<td>3.3</td>
</tr>
<tr>
<td>≥100-125</td>
<td>2.5</td>
<td>3.8</td>
</tr>
<tr>
<td>≥125-150</td>
<td>2.5</td>
<td>3.8</td>
</tr>
<tr>
<td>≥150-250</td>
<td>2.9</td>
<td>4.3</td>
</tr>
<tr>
<td>≥250-400</td>
<td>3.4</td>
<td>5.1</td>
</tr>
<tr>
<td>≥400-650</td>
<td>5.2</td>
<td>7.8</td>
</tr>
<tr>
<td>≥650-1000</td>
<td>6.3</td>
<td>9</td>
</tr>
<tr>
<td>≥1000-1250</td>
<td>7.2</td>
<td>9</td>
</tr>
<tr>
<td>≥1250</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

- Fuel economy standards for 2 & 3-wheelers pay for themselves in reduced fuel cost very quickly
- As with fuel economy standards on cars and trucks, they reduce reliance on oil imports
Controlling vehicle emissions

- Separate emissions standards:
  - 2&3-wheelers,
  - Light-duty vehicles (cars & vans),
  - Heavy-duty vehicles (trucks & buses)
- Policy coverage varies across Asia
- Also possible to regulate specific emissions (e.g. PM and NOx in Japan)
- Health impacts are substantial, but the science and statistics linking emissions to health effects is complex
- Studies attempt to quantify health and economic impacts

- Economic costs of health impacts of air pollution in Jakarta in 2010 estimated at 535 million USD
- Road traffic is among the major sources of air pollution in Greater Jakarta
• Progress has been made over the past decade across many Asian countries in moving to cleaner fuels and vehicle technologies
• One example is the replacement of 2-stroke engines with 4-stroke ones
2- & 3-Wheelers: switching fuels

CNG and LPG retrofits to 3-wheelers:
• Tuk-tuks in Bangkok have operated on LPG for decades
• Many major cities India in successfully converted from gasoline to CNG 3-wheelers (Delhi, Mumbai, also in Dhaka, Bangladesh)
• The immediate result has been reduced PM and HC emissions

Challenges are numerous:
• Ensuring adequate fuel supply (and fueling infrastructure) is a concern: long queues for CNG refueling in Delhi
• Policies for alternative fuels should be based on sound life cycle assessment of their comparative performance in terms of energy efficiency & emissions
• Pricing policies can encourage adoption

Alternative fuels, like CNG and LPG, have fewer emissions, but there are challenges and tradeoffs
Policies to promote alternative fuels should be undertaken with caution, and only with good data
Electric 2-3 wheelers, with no tailpipe emissions and efficiency in the range of 3-6x higher than ICEs, offer far lower energy and maintenance expenditures, superior acceleration, and emit far less GHGs, even on a grid mix that is mostly coal.

- Current e-bike and e-scooters models are cheaper than conventional scooters and motorbikes
  - In congested cities, they are at least as fast as cars
Infrastructure is destiny

• Space utilization and passenger throughput are critical performance metrics in megacities
• Good urban design, including of transport infrastructure networks, can reduce emissions and improve safety
To address huge challenges in congestion and air pollution, Greater Jakarta has been investing in Bus Rapid Transit and Mass Rapid Transit network extensions.
Fuel savings from electrification would be partially offset by increases in electricity demand. Consumption by Heavy-duty vehicles are also growing fast, and could be addressed through fuel economy standards.
Policy options

- Growing megacities must strategically develop strategic mass transit corridors as well as staged rollout of travel demand management measures.
- Regions facing severe pollution should tighten and harmonize emissions standards. Consider two-stage approach: regulations + incentives.
- In-use compliance standards and effective inspection and maintenance programmes are both needed to compliment emissions standards.
- Fuel economy standards for 2&3W-wheelers can reduce states’ reliance on foreign oil and to save their citizens money at the pump.
- Look for opportunities to make and sell electric 2-wheelers, to foster electromobility and to eliminate tailpipe exhaust considerations.
- Provide other incentives for electrification.
- Target relevant stakeholders.

- Smart policy uses good data, and recognises local context, opportunities, and tradeoffs
  - Everyone needs mobility, everyone breathes air