Energy Efficiency of 2-Wheelers in ASEAN

Possibilities, Challenges

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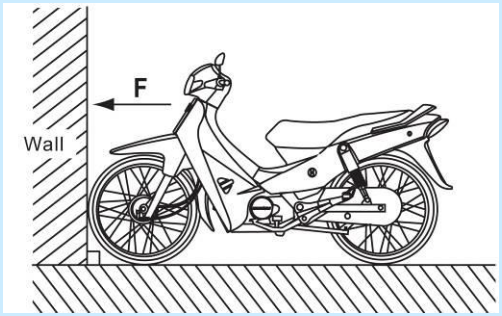
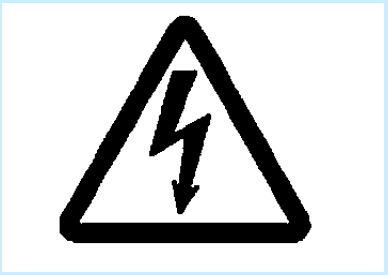




Energy Efficiency and Climate Change Mitigation, Land Transport Sector in ASEAN

- **Objective:** Help implementation of measures to increase energy efficiency and reduce relevant emissions from the land transport in the ASEAN Region
- **Overall term:** 2013 – 2015 (phase I); **2016 – 2018 (phase II)**
- **Budget:** € 2.5 million for phase I; € 3.5 million for phase II
- **Commissioned by:** German Fed. Ministry for Economic Cooperation and Development
- **Implemented by GIZ** in cooperation with the **ASEAN Secretariat**
- **Countries:** Indonesia, **Malaysia**, Thailand, the Philippines, Vietnam

2-Wheeler Motivation and approach:

- Two-wheelers contribute to GHG, air pollution, noise and road accidents

  yet receive little attention by policy makers
- We promote an intergrated approach towards sustainable transport in ASEAN through energy-efficient two-wheelers
- Integration of different measures: fuel economy standards and technical improvements, policies and regulations, inspection and maintenances-programmes, supporting the uptake of electric 2-wheelers through different policies and awareness raising, …

Activities

Factsheet on the potential of electric-two wheelers in Thailand
Supported a NAMA proposal on Energy Efficient Two-wheelers in Malaysia
FE Reports – covering two-wheelers (on-going) in Thailand and Vietnam
Regional workshops and side events at EST and BAQ (tbc)

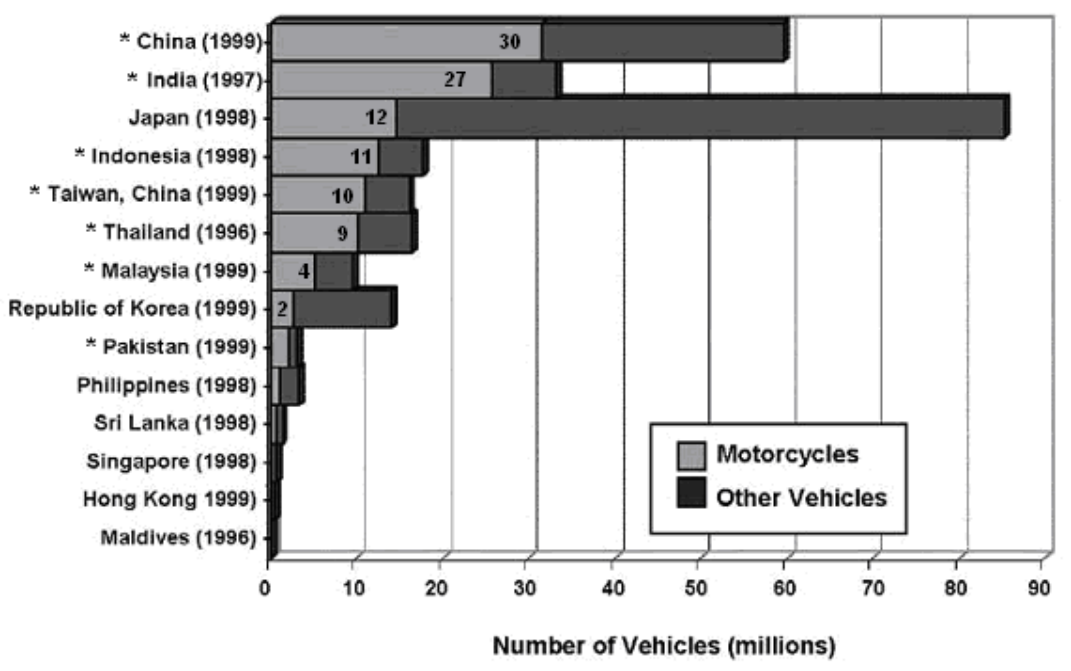
Global Automotive Market: 2W?

Due to their low cost 2-wheelers dominate small transportation units in developing countries.

Typical vehicle life spans are well over 20 years.
•Cost ~ 1,000$
•Top speed 55-70 mph
•130 mpg
It is estimated that there are 200M units worldwide.

China: 1.2 Billion
India: 1.1 Billion
ASEAN: 650M

***For about half of the world*, 2-wheelers are the basic transport of choice.**



Indonesia Parking lot: 250M people

Association of SE Asian Nations

Within SE Asia there are some unique environmental and socio-economic factors. ASEAN countries are homogenizing standards and regulations to have a greater impact by acting as a trading block of 650M people.

Malaysia

Vietnam

Cambodia

Transportation Efficiency

How much energy should it take to get from Parit Buntar to Penang (30km)?

Car (Solo)	2.5 liters of fuel	(2.5l/pax)
Car (2 pax)	2.5 liters of fuel	(1.2l/pax)
Car (3 pax)	2.5 liters of fuel	(0.8l/pax)
Motorbike (1.2 riders)	0.7 liter of fuel	(0.6l/pax)
Bus (with 20 others)	7.5 liters	(0.375l/pax)
Diesel Train (with 200 pax)	30 liters	(0.15l/pax)
Electric Train (with 200 pax)	20 liters equiv.	(0.1l/pax)

Passenger kilometers per unit fuel consumed is the important measure.

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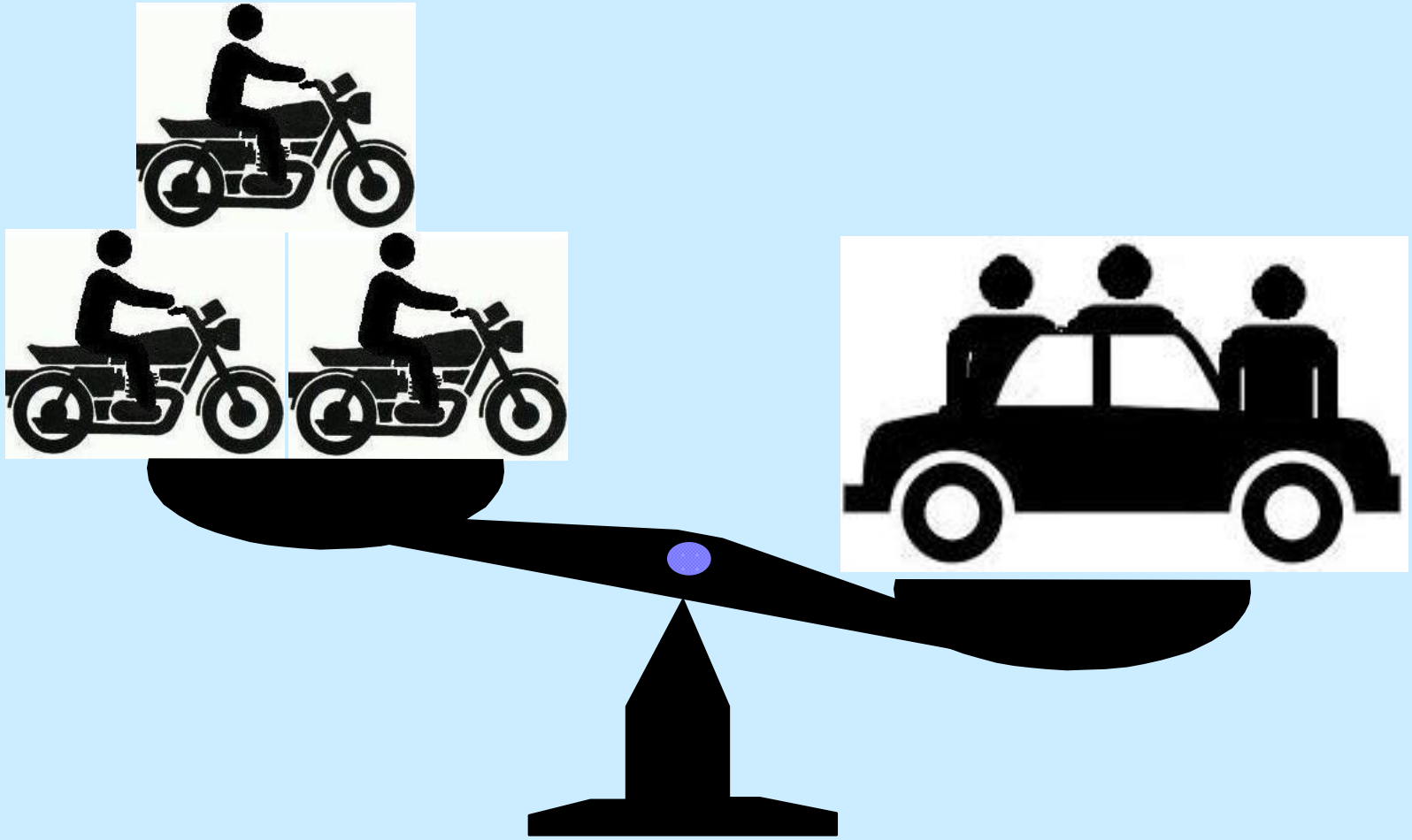
Conclusions:
2-Wheelers are much more efficient than cars
Electric Mass Transit is the most efficient form of transport

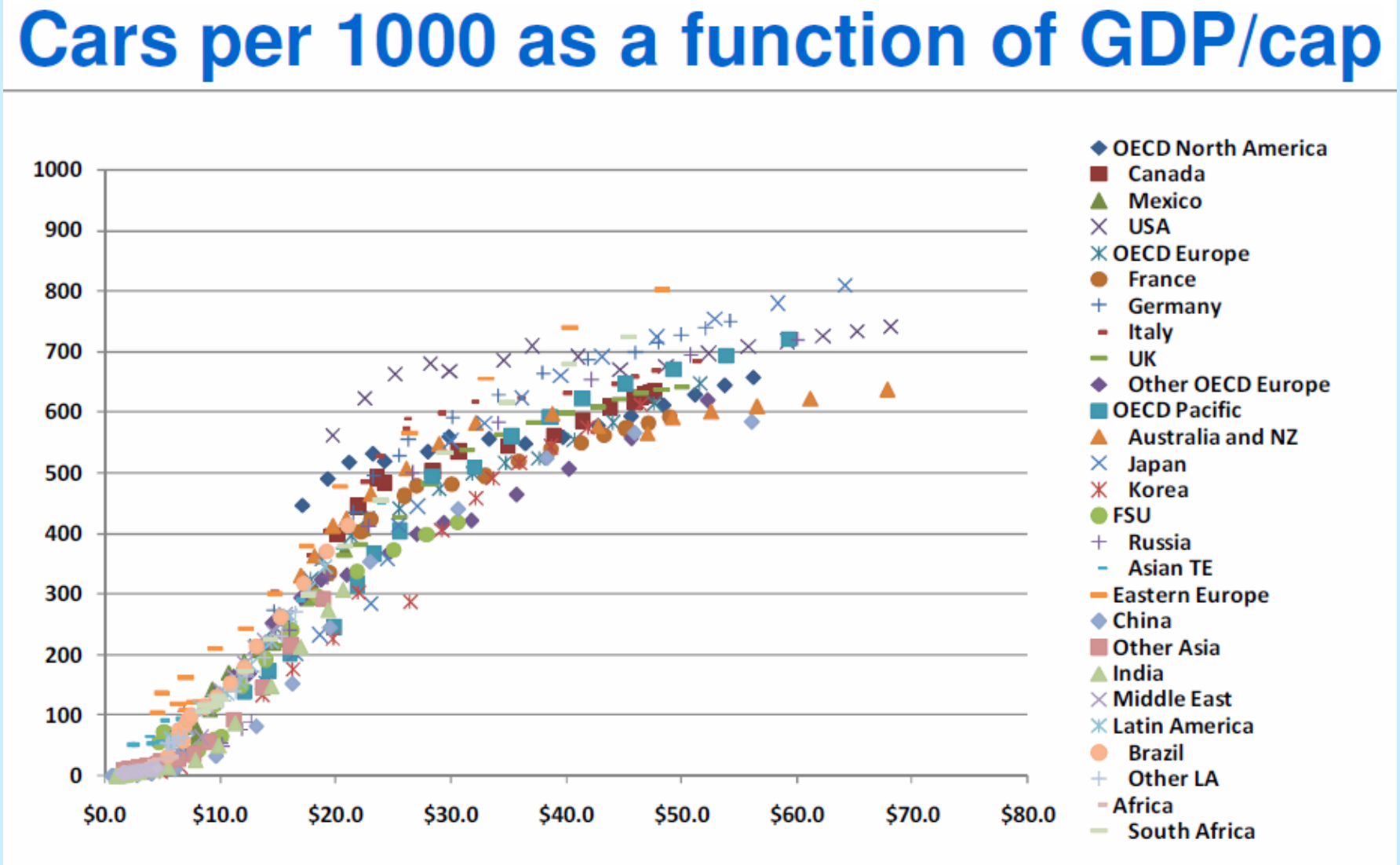
Transportation Efficiency

3 guys on 3 bikes is more efficient than 3 guys in 1 car!



2-Wheelers are so efficient, their actual efficiency is often overlooked.

Economy: More money means more cars



It will be a continual fight to keep people in smaller, more efficient vehicles.

Making 2-Wheelers safer

One way to encourage efficiency is to make 2-wheeler riding safer.
Malaysia leads in Motorcycle Only Infrastructure.

Alternative Fuel: 2-Stroke Direct Injection

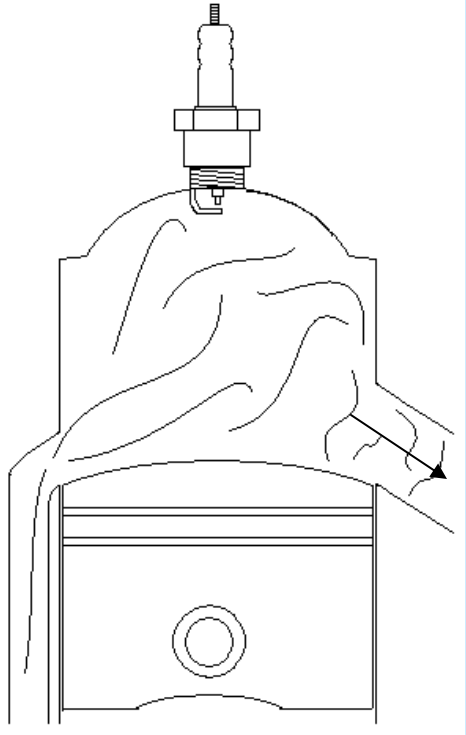
Gasoline Direct Injection solved the problems associated with 2-strokes, but cost too much (350$/bike), and **failed commercially**.

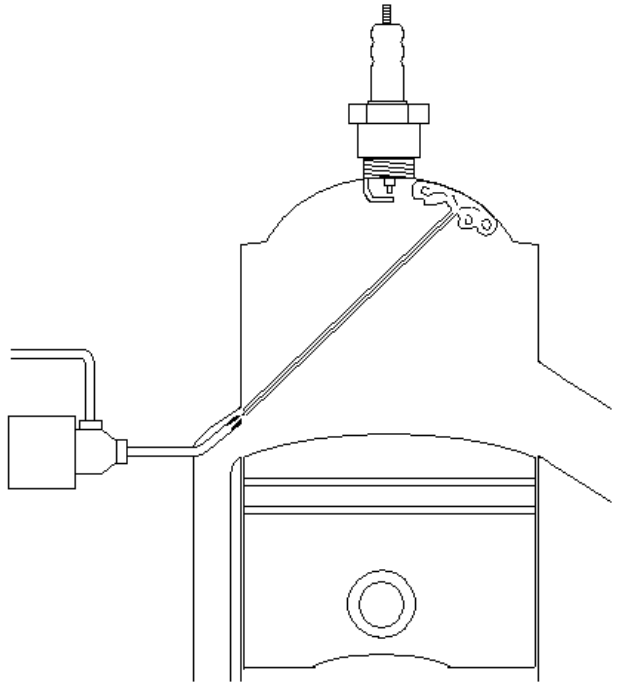
LPG Direct Injection solved the problem with 2-strokes, and nearly succeeded, but 200$/bike (and projected to hit 150$) ***was still too much***.

Problems:
Financing
LPG Availability
Age of Fleet
Mismanagement

Advantages:
80% less smoke
50% cheaper
Cleaner Emiss.

Carbureted vs EFI 2-Stroke





Carbureted LPG systems (Eg. BKK Tuk-TUks, upper left) leak about 1/3 of the air (and fuel) out the exhaust pipe during scavenging (arrow). This is the cause of the high fuel consumption and emissions comes from.

The EFI system (upper right) delivers fuel through an injection nozzle directly to the top of the combustion chamber, eliminating the fuel leakage into the exhaust system. This reduces the fuel consumption and emissions simultaneously.

Alternative Fuel 2-W: LPG/CNG Bi-Fuel

This kit is currently for sale, ***but again it is doubtful that at 40peso/liter gasoline many are likely to prefer the LPG system***.
The small sized CNG tank (20liter) is still under development.

Individual consumers require a 6 month ROI before they'll buy a "clean technology"

Indonesia has expressed interest in providing these kits to get people away from gasoline. Small tanks already available.

E-bikes: Rapidly Growing Market

Our estimates show that “E-bikes” went from ~0% to ~1.5% of the 2-wheeler population in Malaysian in the last 10 years.

They are clean, easy to operate, inexpensive and reliable (if well designed).

E-Motos: Government Preferred

These are higher speed (>50kph) vehicles preferred by the government. The thought is that the Chinese have already dominated the “low end” so Malaysia should focus on the “high-end” next-generation vehicles.

Important Local Data: E-Bikes

Women tend to prefer them for short hops to the store, to pick up kids at school, or visit the agricultural plots and neighbors.

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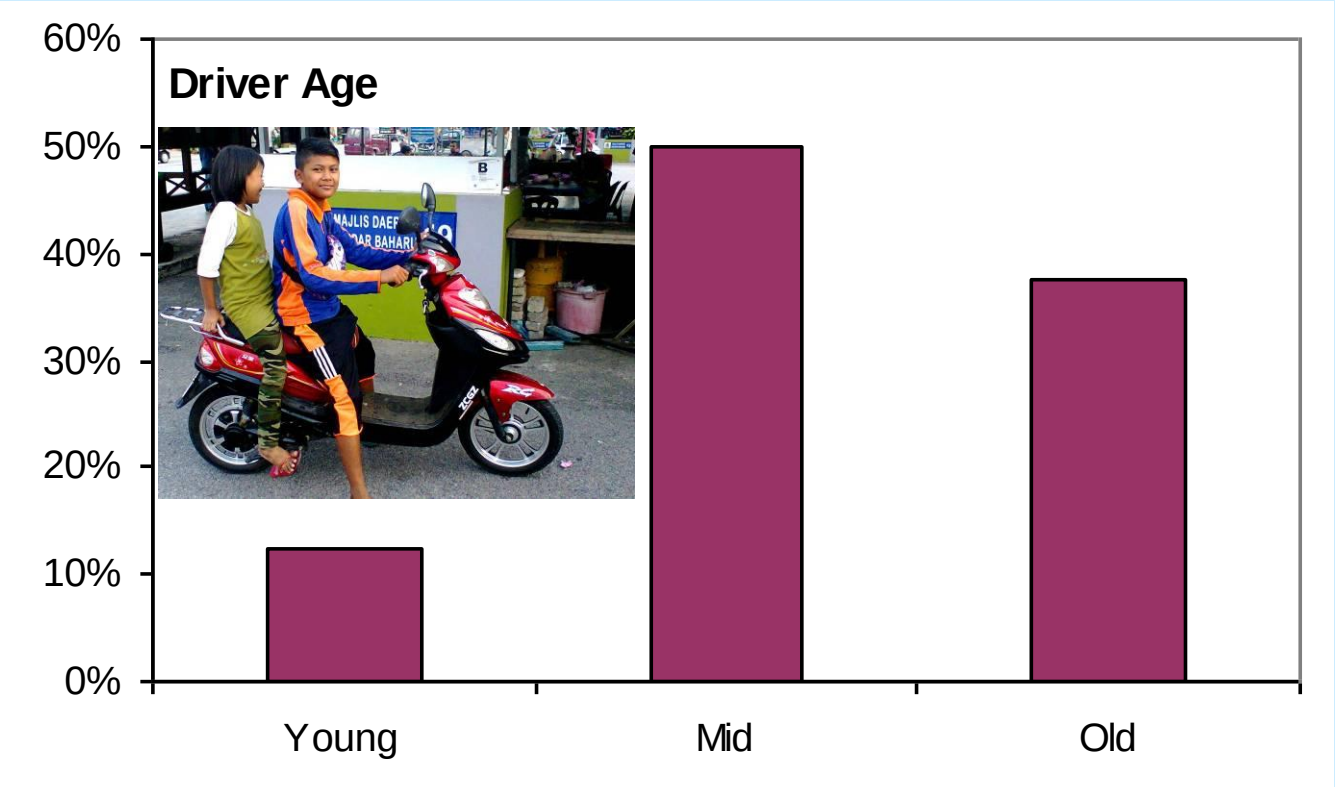
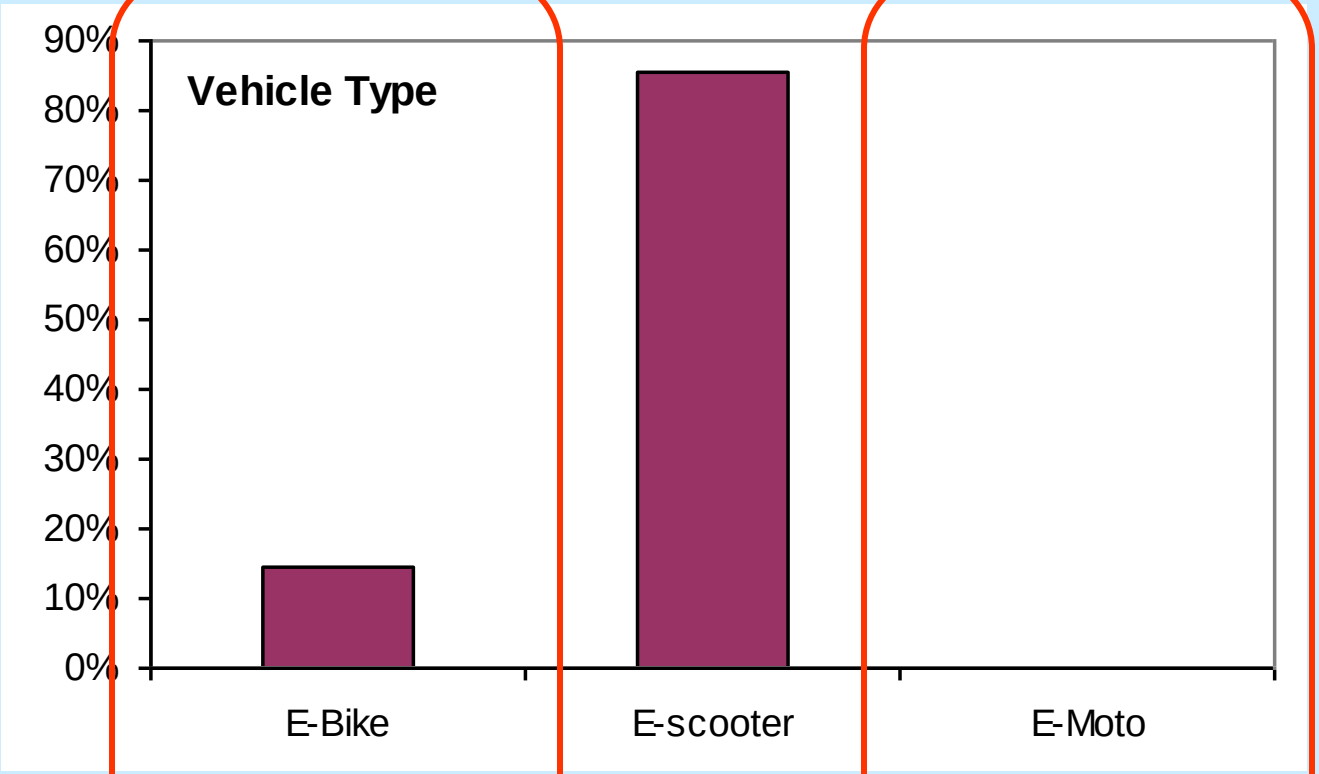


Older riders like that there is no kick starting, shifting or filling up with gasoline ***and their slow!***

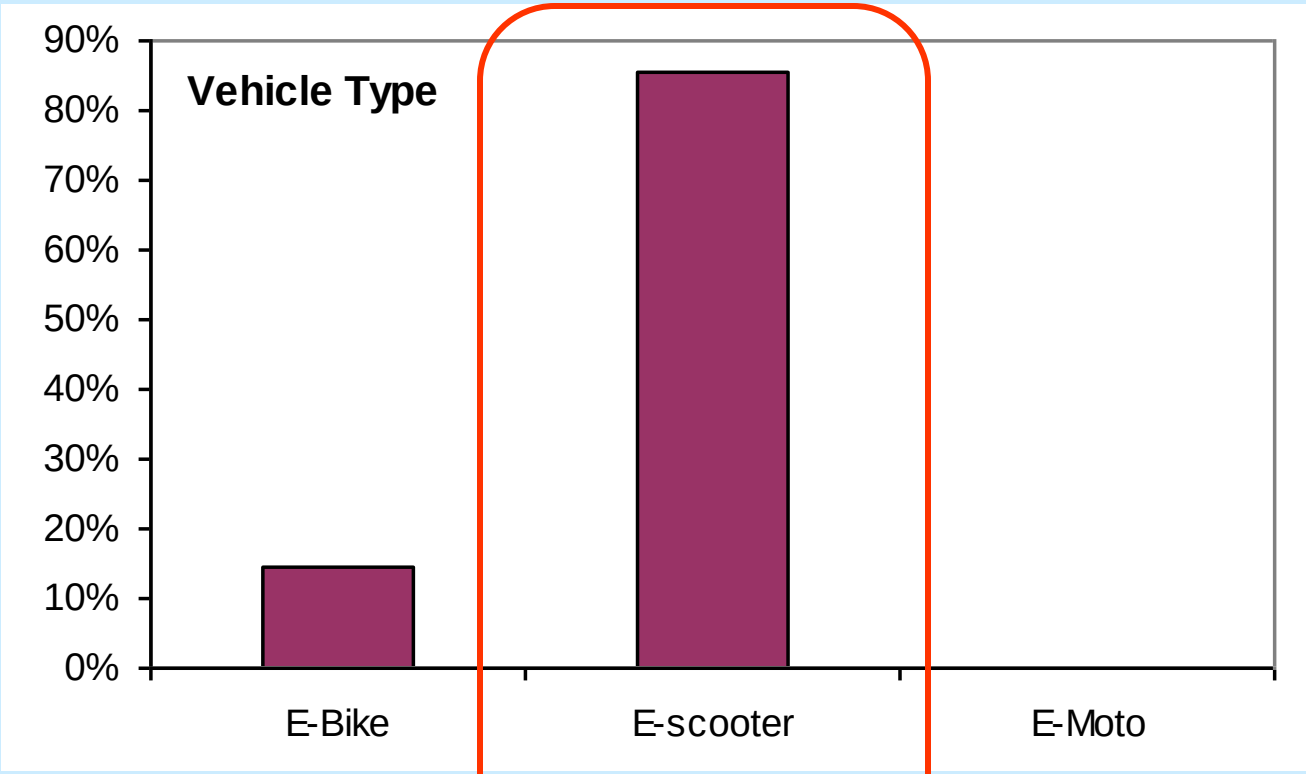
Important Local Data: E-Bikes

Malaysian Standard relates to these category



Important Local Data

Most “E-2 Wheelers” are in an unregulated 25-50kph category



Electric Motorcycle: Commercial Examples

Three “E-motors” (>50kph) are produced in M’sia:

	Price	Top Speed	Range
Modenas:	**1,000$**	**60kph**	**25km**
Roda Prestasi:	**750$**	**50kph**	**50km**
Eclimo:	**3,000$**	**80kph**	**100km**

EV Standards Development

2010: Electrical Motorcycle Standards (MS 2413) developed

2012 Electric Bicycle Standards (2 wheelers <25kph)

2014-2015 Both standards were updated and simplified based on actual conformity testing as well as public feedback.

2015 Electric Motorcycle standard applied to small Electric Cars (which also require additional JPJ approvals)

General Standards Development

Standards need to address 3 main areas:

Safety (for user, and other road users)

Product Quality
Basic quality measurements, not ultra stringent
Does the product achieve it's advertised claims?

Compatibility (ie. interoperability, compatibility with infra)

Quality Factors in Vehicles

What do customers care about? Just look at adverts:

Cost
Speed
Range
Power
Vehicle Life Span
Carrying Capacity

We restricted our standards
To the highlighted areas above.

Quality Factors in Vehicles

What do customers care about? Just look at adverts:

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Carrying Capacity

Gasoline Motorcycles have Well established quality and Life spans. E-motos don't.

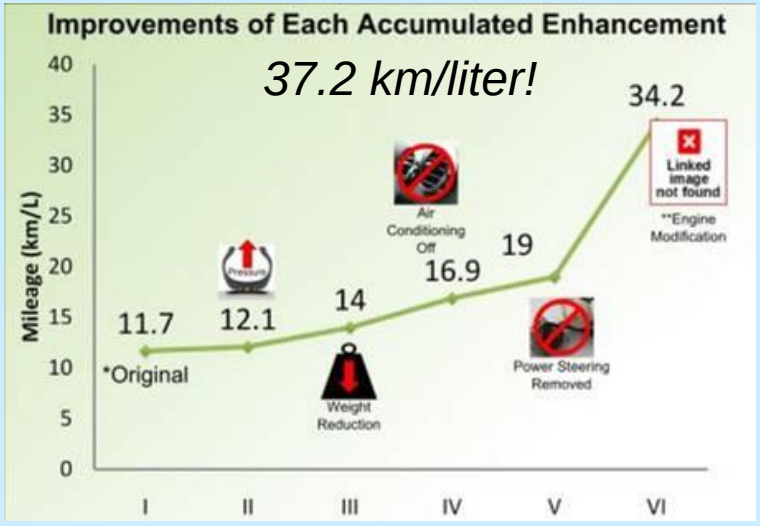
Vehicle Life Span needs to be included!

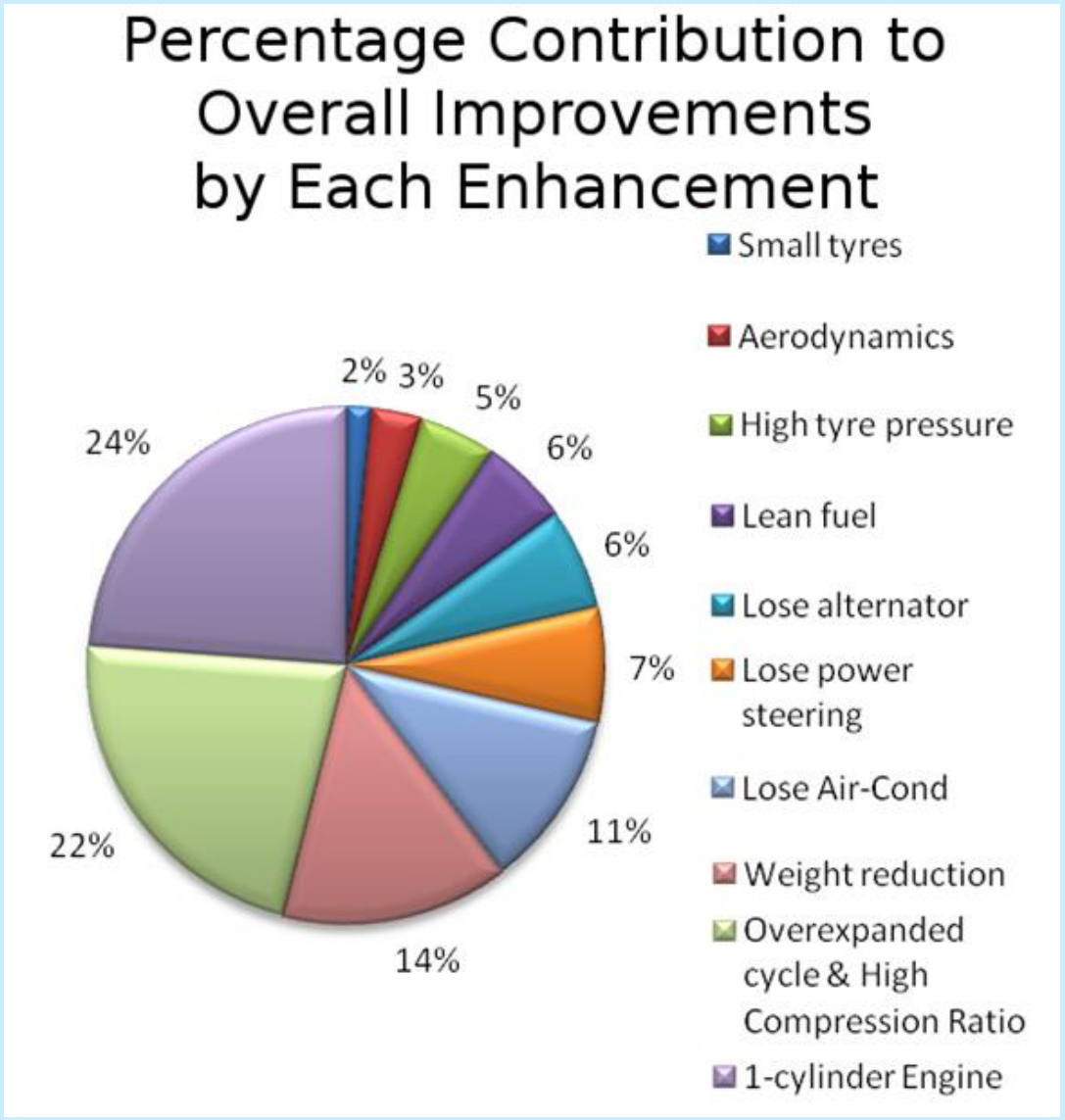
Conventional Vehicle Improvements

Passenger cars have been shown to achieve great improvements in efficiency.

2-Wheelers can do the same!

100-150km/l is achievable





Electric Motorcycle: Economic Projections

2-Wheeler Technology	Power (kW)	Top Speed (km/h)	Range (km) per charge/fill up	Cost ($ per 100km)	Purchase Cost ($)
Conventional ICE	6.0	90	200	0.83	1000
Energy Efficient ICE	3.5	75	400	0.40	1000
ICE – LPG	5.5	85	300	0.40	1200
ICE – CNG	4.5	80	150	0.40	1300
E-Motorcycle	3.5	75	50	0.20	1500
E-Scooter	1.5	50	40	0.20	500

With an annual accumulation of 7000km:

Switching from gasoline to LPG might save 30$ per year.

An Electric 2-Wheeler might save 44$ per year.

ROI is too long to justify the purchase to an end user based on fuel savings alone.

Should we subsides efficient technologies?

ASEAN Wide Integration

A “small country” like any of the ASEAN countries will have a hard time supporting an independent motorcycle manufacturer (much less automobile manufacturer).

As we are one of the biggest markets in the world for 2-wheelers, why don’t we standardize, harmonize and develop our own products for our markets?

Why are we sending all our money to the Japanese and Chinese?

Working together on a larger scale we will be able to leverage tools and talent as well as improving the efficiency and lowering the cost of implementation and keep more money in our own market.

We need to Plan for a *Realistic* Future

Plan for the future:

- More People
- More, Bigger Cars and Motorcycles
- Worse Traffic
- More people in the city

Possibilities:

- Unified taxation based on vehicle efficiency
- Better Urban and Infrastructure planning
- Improved inter-modal connectivity
- Light Rail expansion
- Re-develop traffic infrastructure in existing Urban Centers

Highlights of GIZ Study (M'sia):

+ Good centralized Standards and Legislation Development

+ Enforcement Agencies (JPJ, Puspakom) do a good job at their

- No central Laboratory for new vehicle/Technology evaluation
Need something like US EPA. "Haze" is an ASEAN issue

- No Loaded Emissions Testing
Need to implement loaded Dyno testing of vehicles

- Regulations are often technology specific
Should move to Fuel Efficiency based (or CO2) Standards

- Implementation on local level:
Often local authority doesn't have tools, training or awareness

- No on-going compliance for in-use vehicles
Recommend Emissions/FE/Safety testing at 10, 15, 20 years

Small Vehicles (especially 2-wheelers) are more efficient
Need to make safer (Free 1st class insurance, more 2-W only infra)

Conclusions

•There is a need to encourage efficient vehicles, including 2-wheelers.

•Alternative Fuel kits are available for 2-wheelers. They will not succeed on their own merits at today's fuel prices.

•Low Power Electric 2-Wheelers are becoming more popular.

•Proper STANDARDS should be established, and enforced, especially including Electric Vehicle Range and Life Span.

•There may be a “nitch” for high-efficiency conventional ICE 2-Wheelers.

End of Main Presentation

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