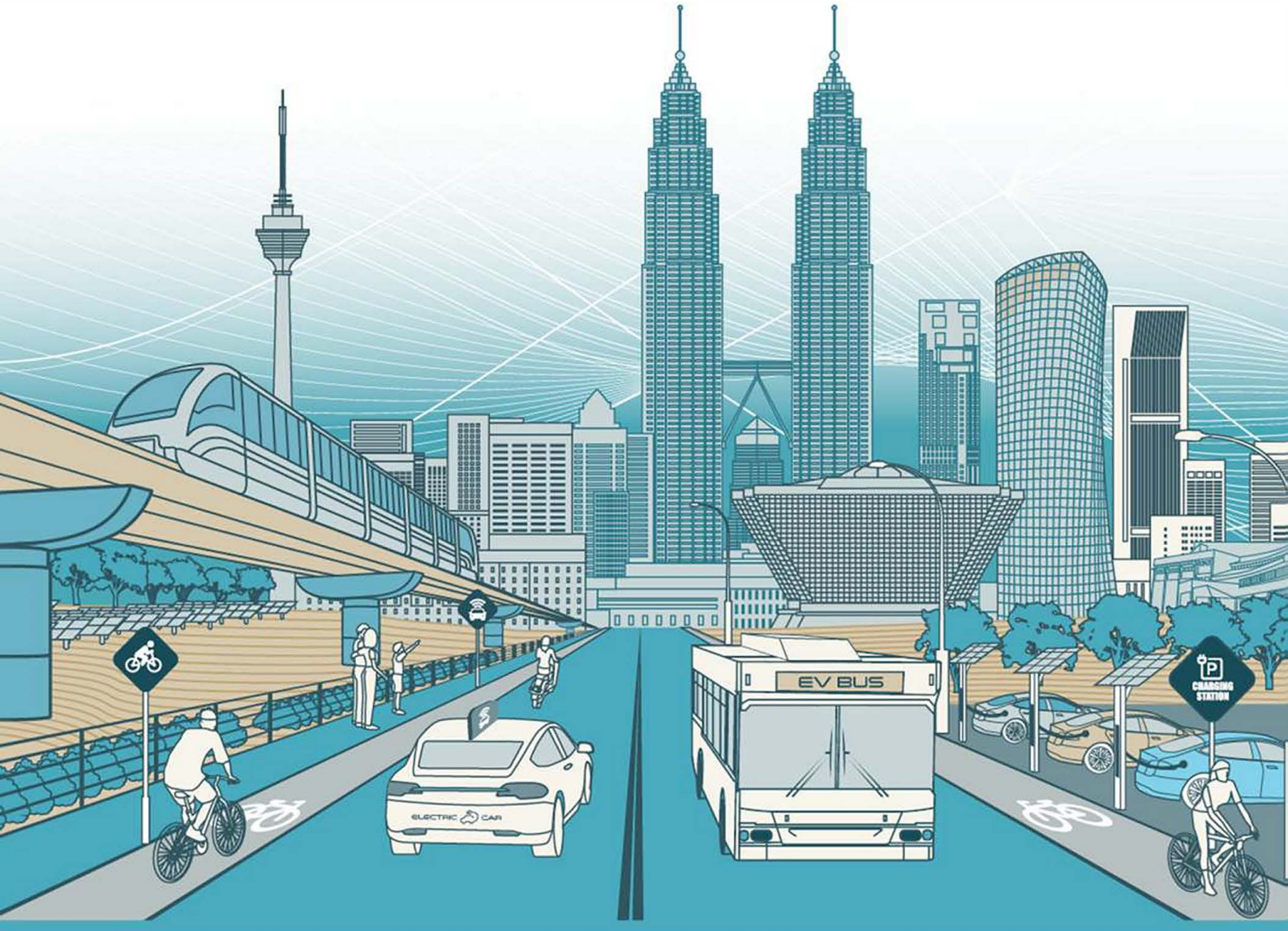

LOW CARBON MOBILITY BLUEPRINT

Decarbonizing Land Transportation

Low Carbon Mobility Blueprint 2021-2030

First Edition, 2021

About Low Carbon Mobility Blueprint

The objective of the Low Carbon Mobility Blueprint 2021-2030 is to to assess the best options in energy and GHG mitigation planning in the transport sector, in particular land transport, using scenario analyses of a business-as-usual case and similarly for 2030.

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EXECUTIVE SUMMARY

Photo by Nik Radzi fromUnsplash

Introduction

Malaysia is a party to the United Nations Framework Convention on Climate Change (UNFCCC). Consonant to the Convention, Malaysia ratified the Kyoto Protocol in 2002 and the Paris Agreement in 2016. Under the Paris Agreement, Malaysia communicated the country's Nationally Determined Contributions (NDC) intending to reduce 45% GDP emissions intensity by 2030 relative to the emissions intensity in base year 2005. This consists of a 35% reduction on an unconditional basis and a further 10% conditional upon receipt of climate finance, technology transfer and capacity building from developed countries.

In 2017, Malaysia's total Final Energy Consumption (FEC) stood at 62,848 ktoe (kilo tonnes of oil equivalent), which is 9.8% higher than the previous year. The transport sector was the second fastest growing sector overall in terms of energy consumption with a total FEC of 23,522 ktoe or 37% of the country's total. Within the transportation sector, road transport dominates – accounting for more than 90% of energy consumption. The transportation sector also consistently remained the second largest greenhouse gas (GHG) emitting sector, accounting for 20% of Malaysia's total greenhouse gas (GHG) emissions in 2014 of which 18% originated from road transportation (55,366 Gg CO2eq) (NC3 BUR2).

As a sector which records the highest proportion of energy consumption, it is imperative that a dedicated, concerted and comprehensive action plan be designed to mitigate the impact of the transport sector on energy and GHG emission in Malaysia.

In 2018, the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) commissioned a study leading to a Low Carbon Mobility Blueprint (LCMB). The objective is to assess the best options in energy and GHG mitigation planning in the transport sector, in particular land transport, using scenario analyses of a business-as-usual case and similarly for 2030. The output is expected to complement Ministry of Environment and Water's (KASA) existing Green Technology Master Plan with clearer targets and action plans specific to the transport sector in Malaysia.

Alignment with National Policies

While Malaysia has a very mature policy development structure and advanced transportation infrastructure, there are still areas which can be improved to reduce energy consumption and GHG emissions. The recommended strategies and action plans have been the result of careful analysis of existing key national policies.
The 11th Malaysia Plan spelled out the government's intention to shift from conventional and costly 'grow first, clean-up later' path to a greener trajectory – Green Growth – to ensure that socio-economic development is pursued more sustainably (RMK-11).

The coming 12th Malaysia Plan is expected to continue the focus on low carbon transport and cities in line with the Sustainable Development Goals (SDGs) agenda which the Malaysian government seeks to achieve.

Although sustainable transport is not represented by a standalone SDG in the 2030 Agenda, it is mainstreamed in a direct or indirect manner into many of the proposed SDGs especially those related to energy, health, infrastructure, food security, climate change, cities and human settlements (UN 2015).

Three new or revised national-level Action Plans are being drafted for the National Transport Policy, National Automotive Policy 2019 and National Biofuel Policy 2019 concurrent to the finalisation of this Blueprint and Action Plan. All three policies and action plans are generally integrated and are in support of each other to achieve a low carbon mobility ecosystem for the country.

The Low Carbon Mobility Blueprint and Action Plan (LCMB) relation with Sustainable Development Goals (SDGs) are:

Goal 3: Improving road safety
Goal 7: Improving energy efficiency in the transport sector
Goal 9: Development of quality, reliable, sustainable and resilient transport infrastructure
Goal 11: Improvement of urban public transportation system
Goal 12: Sustainable consumption and production patterns of fossil fuel
Goal 13: Climate impacts on transport, and mitigation and adaptation measures

National Transport Policy (NTP) 2030

Policy Thrust 4: Advance towards green transport

- ST 1: Enforce compliance to acts/regulations and shift towards international environmental standards
- ST 2: Prioritise public transport network as the fundamental structure in charting out sustainable spatial and transportation growth in urbanised areas
- ST 3 : Accelerate implementation of low carbon mobility initiatives
- ST 4: Institute measures to control pollution, noise and waste from the transport sector

National Policy on Climate Change 2009

- KA4-ST2:Identify and recommend options towards low carbon economy for eight sectors, one of which is transportation
- KA13-ST4:Incorporate measures, including mobilising financing and technical assistance into 12 areas, one of which is transportation
- KA20-ST5:Promote RE and EE to reduce GHG emissions in the transportation sector
- KA25-ST6:Integrate measures into policies, plans, programmes and projects in 12 areas, one of which is transportation

National Automotive Policy (NAP) 2019

- Next generation vehicle
- Mobility as a service (MaaS)
- Industrial Revolution 4.0 (IR 4.0)
- Continuation of NAP 2014 primary objectives
- Biodiesel usage

Green Technology Master Plan (GTMP) 2030

Key areas targeted for the mainstreaming of green technology

- Public transportation: 40% mode share on PT
- Private transportation: 100% EEV
- Cleaner fuel: Biofuels

National Physical Plan 3 (NPP 3)

Key Thrust 2: Spatial sustainability and resilience to climate change. Strategic Thrust KD3: Low carbon city and sustainable infrastructure

- Creating low carbon cities and development
- Developing low carbon mobility

Low Carbon Mobility Blueprint (LCMB)

FA A: GHG emission & energy reduction via vehicle fuel economy & emission improvement
- S1: Encouraging adoption of low emission vehicle
- S2: Strengthen eco driving program

FA B: GHG emission & energy reduction via electric vehicle adoption
- S3 (i): Adopting the electric car
- S3 (ii): Adopting the electric bus
- S3 (iii): Adopting the electric motorcycle

FA C: GHG emission & energy reduction via alternative fuel adoption
- S4: Enhancing use of biodiesel
- S5: Creating an eco-system for growth of alternative fuel and energy industry

FA D: GHG emission & energy reduction via mode shift
- S6: Shifting private transport to public transport
- S7:Promoting public transport through land-use development
- S8: Improving traffic flow
- S9: Shifting freight mode from road to rail
- S10: Promoting active and micro mobility

THE VISION OF LCMB 2021-2030 IS TO DRIVE THE PRINCIPLES OF SUSTAINABLE MOBILITY

to assess the best options in energy and GHG mitigation planning in the transport sector, in particular land transport, using scenario analyses of a business-as-usual case and similarly for 2030.

OBJECTIVES

- **Energy – Reduction in total primary energy supply and energy consumption**
- **Economy – Fuel expenditures savings and industrial expansion**
- **Environment – Greenhouse gas emission reduction**

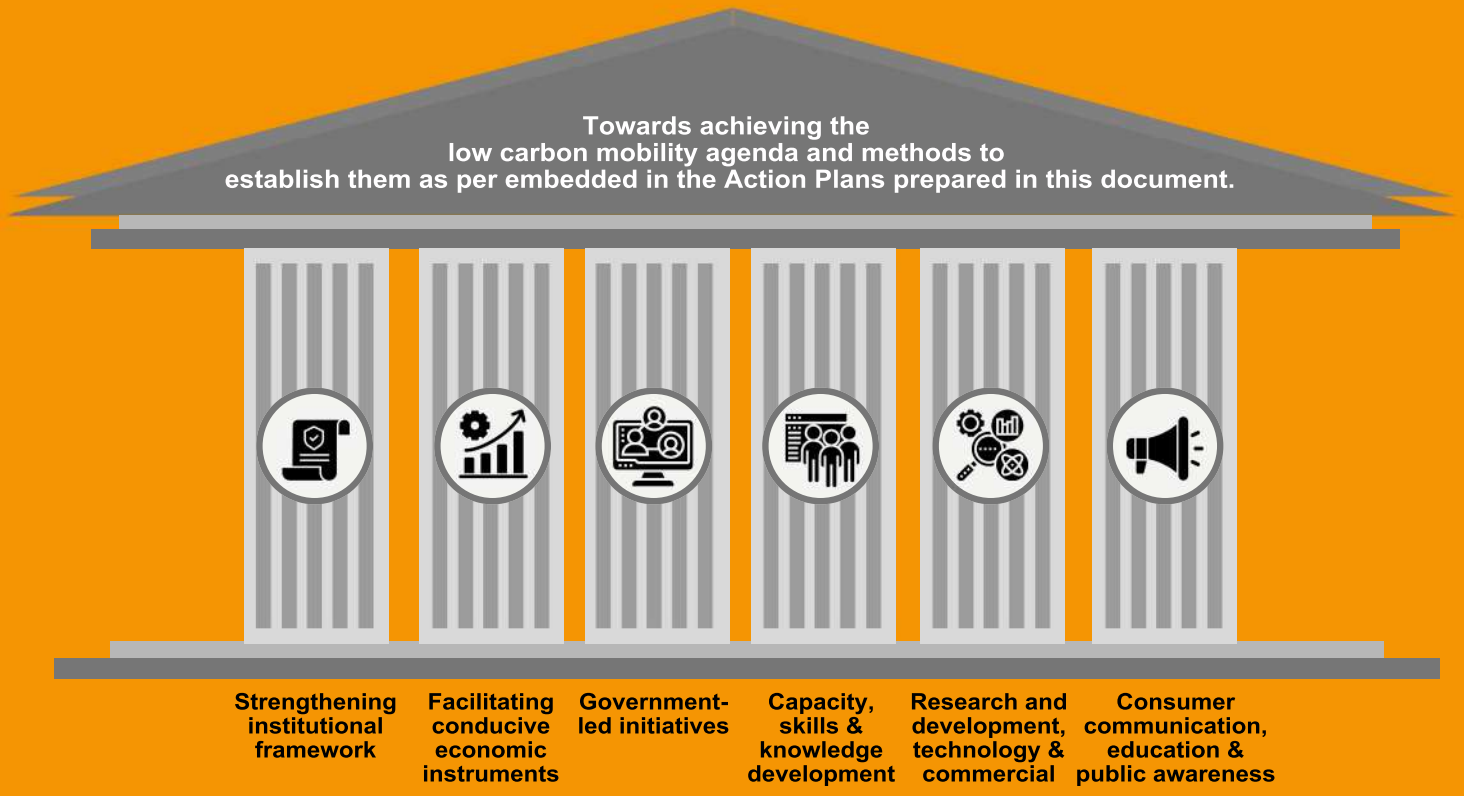
FOCUS AREAS

The output of the LCMB study is organised into four focus areas, namely:

1. **GHG emission and energy reduction via vehicle fuel economy and emission improvement**
2. **GHG emission and energy reduction via electric mobility adoption in strategic applications**
3. **GHG emission and energy reduction via alternative fuel adoption**
4. **GHG emission and energy reduction via mode shift**

4 focus areas and 10 strategies had been developed

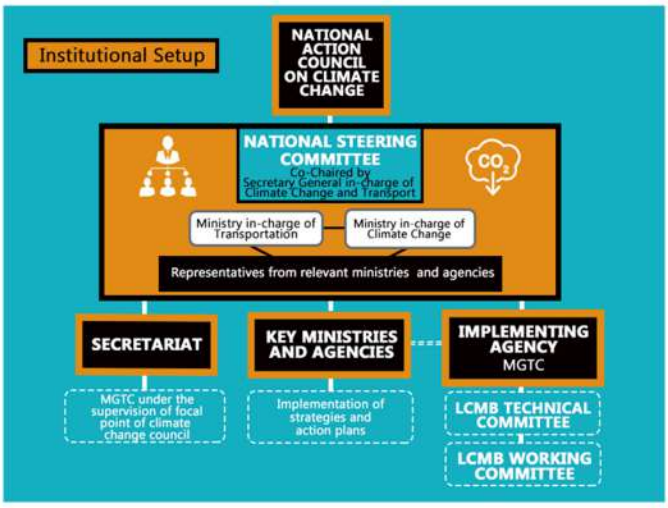
The Six Strategic Actions for Low Carbon Mobility



Action 1: Strengthening institutional framework via establishment of a dedicated council for Low Carbon Mobility Blueprint and Action Plan (LCMB) implementation

- Climate change and transportation governance in Malaysia are strongly determined at the national level. However, due to decentralisation of economic and political power to state and local governments, it is important to ensure there is coherence in existing policies at different levels to ensure a sustainable pathway for achieving low carbon mobility. Spatial planning at city and district levels must as much as possible incorporate principles and action plans suggested at a national level document, that is, the Low Carbon Mobility Blueprint and Action Plan. In addition, the LCMB should also include a mode shift and planning for electric charging infrastructure.

- A council should be established as the national focal point on low carbon mobility policy, strategy and programme formulation. The council plays a coordinating role among sectorial agencies. It should have an institutional structure composed of an operating secretariat and several working groups to formulate and coordinate policy implementation with nationwide responsibility to support low carbon mobility agendas and programmes.



- The council can be in the form of a Steering Committee (SC) to be co-chaired by the ministry in-charge of environment and climate change and the ministry in-charge of transportation. The members of the SC would comprise of representatives from ministries and agencies that have interest and/or stake in the environment, climate change and transportation. The main task of the SC is to undertake the implementation and monitoring of the LCMB. The SC will also be responsible to conduct a mid-term review and propose necessary improvements and/or remedial actions to achieve the desired objectives of the LCMB.

- Upon adoption of the LCMB, the SC will need to mobilise resources through discussions with key agencies to move forward the implementation of the LCMB. Lead agencies for each of the action plan need to engage with supporting agencies so that resource mobilisation are realised effectively. Resource mobilisation encompasses both funding and human resource mobilisation.

Action 2: Facilitating conducive economic instruments

- To incentivise households to purchase more environmental-friendly Energy Efficient Vehicles (EEV), a surcharge-rebate system can be introduced within the vehicles' excise tax system. In the early phases of the implementation, the number of vehicles subject to surcharge is likely to be larger than those given rebates. Thus, there is no fiscal outlay for the government to implement the system. Once the volume of surcharge becomes less than rebates approved, it signals that vehicle stock are becoming pre-dominantly environmental-friendly EEV.

- A fuel levy (for example RM0.01 per litre) on all diesel and petrol purchase can be instituted to convince fuel users to switch to cleaner types of energy such as biodiesel, biogas or electricity. Since a fuel levy is a flat-rate tax, the fuel levy collects the same amount of money regardless of price changes in fuel. In this respect, the levy maintains the government's expected revenue from fossil fuel which then can be utilised to finance low-carbon initiatives particularly at local government level.

- An extension of Green Technology incentives until 2025 should be seriously considered. The incentives include those that benefit purchasers; i.e., Green Technology Financing Scheme (for users), Green Technology Financing Scheme (for users and producers of Green Technology), Green Investment Tax Allowance (GITA) Services, GITA Assets, GITA Projects; and one that supports manufacturers through subsidised financing, that is, GTFS. It is proposed that these incentives not only apply to private companies but also include government-owned companies that are involved in public transport such as Prasarana.

- While the Government offers a wide range of incentive programs for investors, both tax and non-tax, none are specifically dedicated to incentivising investment in 'green' production and distribution activities such as EV production, biodiesel, biogas production and distribution. The new tax incentive scheme should be targeted at getting companies to anchor substantive high value 'green' activities and strengthen capabilities, notably innovations that are currently still expensive due to raw material cost and smaller economies of scale.

Action 3: Government-led initiatives

- The government has a big and important role to play in spearheading and propelling the private sector, business communities and the general public to move towards implementing low carbon mobility options and practices. The role of government institutions and government-linked companies are crucial for the successful introduction of low carbon mobility initiatives. The government can, for example through circulars, direct its institutions to embark upon low carbon mobility options in its operations.

- The government shall therefore be the pioneer in implementing internal policies for encouraging low carbon mobility options such as procuring energy efficient low emission vehicle fleet (such as EV) for government agencies and government-linked companies, and giving incentives to employees to commute on public transport. This will create an increase market demand towards low carbon mobility options and practices since the government is spearheading this pursuit.

Action 4: Capacity, skills and knowledge development

- Provide support for the development of professionals in the transport planning and urban planning fields. These professionals will be involved in designing road networks and a public transportation transit system that promote low carbon mobility at state and local government levels.

- Provide support for the development of institutional capability of agencies/organisations in both public and private sectors. These agencies will be responsible for the planning, supervision and promotion of energy conservation implementation and low carbon mobility measures.

- Establish detailed data sources with respect to energy consumption and GHG emission to facilitate monitoring and planning future policy directions. A repository of all relevant data related to the transport sector, energy consumption and GHG emission needs to be established and made accessible to all related government agencies for the purpose of facilitating the implementation and monitoring of LCMB.

Action 5: Research and development, technology nurturing and commercialisation

- The introduction of new forms of people mobility and freight distribution such as innovative soft mobility schemes, drive-sharing, ride-sharing, crowd shipping, crowd delivery, connected and automated vehicles, innovative flying vehicles, and mobility as a service, could revolutionise transport demand with major consequences for the spatial organisation of cities and their neighbourhoods.

- Research institutions (universities, private entities etc.) need to be involved in enhancing research in low-carbon mobility, whether in technology or in behavioural change towards low-carbon mobility options and practices.

- Local authorities need to work closely with public transport planners and companies to help the latter plot feasible business plans and reasonable levels of service to the public. Investors will not be attracted in running a public transport business if there is not enough demand for its services. With better planning and cooperation between all parties, a win-win solution could be arrived. Local authorities, thus, will not be unduly burdened to subsidise public transport services. In the same vein, public transport operators are able to generate reasonable economies of scale and profitability.

Action 6: Consumer communication, education and public awareness

- Develop effective CEPA activities that create behavioural modification towards practices of sustainable transport through use of 'green' vehicles (such as electric cars, e-buses, FCEV and B100 buses). These vehicles can also act as advertisements for cleaner transportation options.

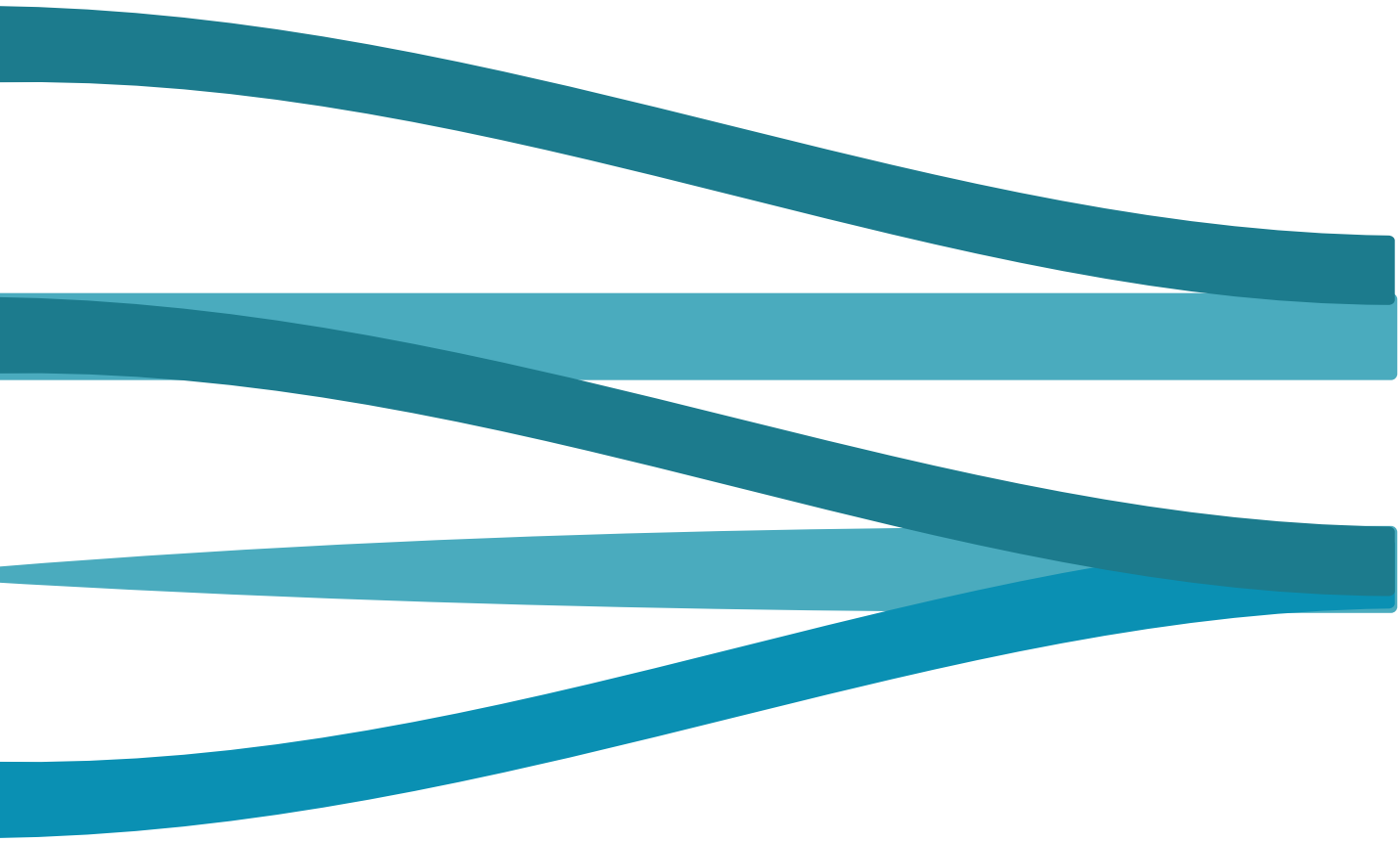
- Strengthen CEPA for companies to opt for low-carbon transportation assets and services. These include communication of tax incentives and subsidised financing, and organising 'match-making' platforms or events for companies to connect with local and foreign suppliers.

- Involve the Ministry of Education in CEPA activities to allow students at all levels to be more aware of the practical aspects of low-carbon mobility options. Experiential learning should be introduced to students that would lead to behavioural changes in the desired direction.

- Plan and execute effective media engagement in CEPA activities to promote LCMB. The SC can lead LCMB promotion through CEPA activities so that public awareness of the LCMB can be realised more effectively.

LOW CARBON MOBILITY BLUEPRINT

DECARBONIZING LAND TRANSPORTATION



4 FOCUS AREAS

10 STRATEGIES

45 ACTION PLANS

4 Focus Areas and 10 Strategies

Focus Area 1 : GHG emission & energy reduction via vehicle fuel economy & emission improvement

S1: Encouraging adoption of low emission vehicles
S2: Strengthen eco driving program

Focus Area 2 : GHG emission & energy reduction via electric vehicle adoption

S3 (i): Adopting the electric car
S3 (ii): Adopting the electric bus
S3 (iii): Adopting the electric motorcycle

Focus Area 3 : GHG emission & energy reduction via alternative fuel adoption

S4: Enhancing use of biodiesel
S5: Creating an eco-system for growth of alternative fuel and energy industry

Focus Area 4 : GHG emission & energy reduction via mode shift

S6: Shifting private transport to public transport
S7: Promoting public transport through land-use development
S8: Improving traffic flow
S9: Shifting freight mode from road to rail
S10: Promoting active and micro mobility

SCENARIO 1: Increase in population and travel needs

The population of Malaysia grew from 28.3 million in 2010 to 31.7 million in 2016 and is estimated to reach 41.5 million by 2040. Coupled with increasing affluence and mobility trends, it is estimated that Malaysians will make an estimated 131 million daily trips in 2030, a significant increase from the 40 million trips in 2010.

Increasing population

Population

32.6 million people
(DOSM, 2019)

Household

8 million household
(DOSM, 2019)

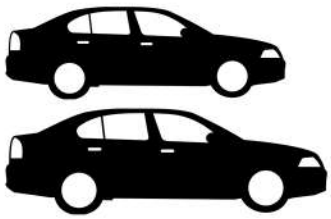
Living area

76.2% of urban population
(DOSM, 2019)

Increase in mobility needs in Malaysia

Vehicle population

31.2 million units
(DOSM, 2019)



Average Annual Kilometre Travelled (AAKT)

Per person

21,184 kilometre
(MIROS, 2018)

Demographic trends indicate that Malaysia faces an increase in life expectancy, coupled with a gradually decreasing fertility rate. This demographic trend, coupled with a significant increase in number of trips, will require rethinking of current transport strategies to ensure transportation is both accessible and sustainable.

SCENARIO 2: Increase in vehicle Total Industry Volume (TIV)

The volume share of each vehicle category for the road transport segment is shown in Figure 1.4. In the transportation discipline, volume refers to the number of vehicles of a certain category, and volume share refers to the percentage of a certain vehicle category out of total vehicle population.

The car and motorcycle categories were the two categories with the biggest share, each numbering slightly above 45% of total vehicles. This meant that 91.5% of the country's vehicles consisted of cars and motorcycles. The next biggest category was goods vehicle with a close to 4.5% share.

As a whole, the total number of vehicles increased by 15.6% in the span of four years (2014 to 2018). The increment of registered vehicle population within the period was more than one million vehicles each year. It should be noted that the number of vehicles shown was based on the accumulation of newly registered vehicles into the registered population excluding information of deregistered vehicles from the system.

	2014	2015	2016	2017	2018
Car	11,199,910 44.62%	11,867,906 45.13%	12,445,692 45.42%	13,018,509 45.64%	13,618,028 45.78%
Motorcycle	11,629,265 46.33%	12,094,465 45.99%	12,559,286 45.84%	13,054,874 45.76%	13,607,369 45.75%
Taxi	105,689 0.42%	108,127 0.41%	110,903 0.40%	111,574 0.39%	112,224 0.38%
Hire & Drive Car	58,945 0.23%	63,876 0.24%	68,828 0.25%	72,655 0.25%	79,370 0.27%
Buses	65,044 0.26%	66,334 0.25%	67,490 0.25%	68,657 0.24%	69,675 0.23%
Goods Vehicle	1,159,872 4.62%	1,197,901 4.55%	1,232,233 4.50%	1,267,552 4.44%	1,308,269 4.40%
Other Vehicles	882,467 3.52%	900,192 3.42%	916,275 3.34%	932,760 3.27%	950,252 3.19%
TOTAL	25,101,192	26,298,801	27,400,707	28,526,581	29,745,187
	14,327,201	14,764,527	15,255,375	15,708,361	NA

Figure 1.4: Number of accumulated registered vehicles by vehicle category and its corresponding volume share and total number of driving licenses
Source: Jabatan Pengangkutan Jalan (JPJ) + LCMB analysis, Jabatan Keselamatan Jalan Raya (JKJR)

SCENARIO 3: Increase in Vehicle Kilometre Travelled (VKT)

In the computation of GHG emission, the number of registered vehicles was not used for several reasons. First, the number of total registered vehicles was far larger than the number of licenses issued. Secondly, if it was used, it would result in higher calculated values of energy consumption and GHG emission compared to what was reported in the National Energy Balance (NEB) and the Malaysia Third National Communication and Second Biennial Update to the UNFCC (BUR) reports. Hence, GHG emission calculation utilised the estimated vehicle kilometre travel (VKT). VKT is the distance travelled by any vehicle in kilometres, adjusted proportionately to satisfy these conditions:

- The number of vehicles on the road cannot exceed the number of licenses, and
- Energy consumption and GHG emission values match the values reported in the NEB and BUR reports.

The GHG emission for each land transport mode is shown in Figure 1.5. Petrol cars, with the largest VKT, made up about 50% of total land transport GHG emissions. Goods vehicles, with only 6.4% of total VKT, discharged 22.8% of total emissions while motorcycles, with 41.3% of total VKT, emitted only 12.1%.

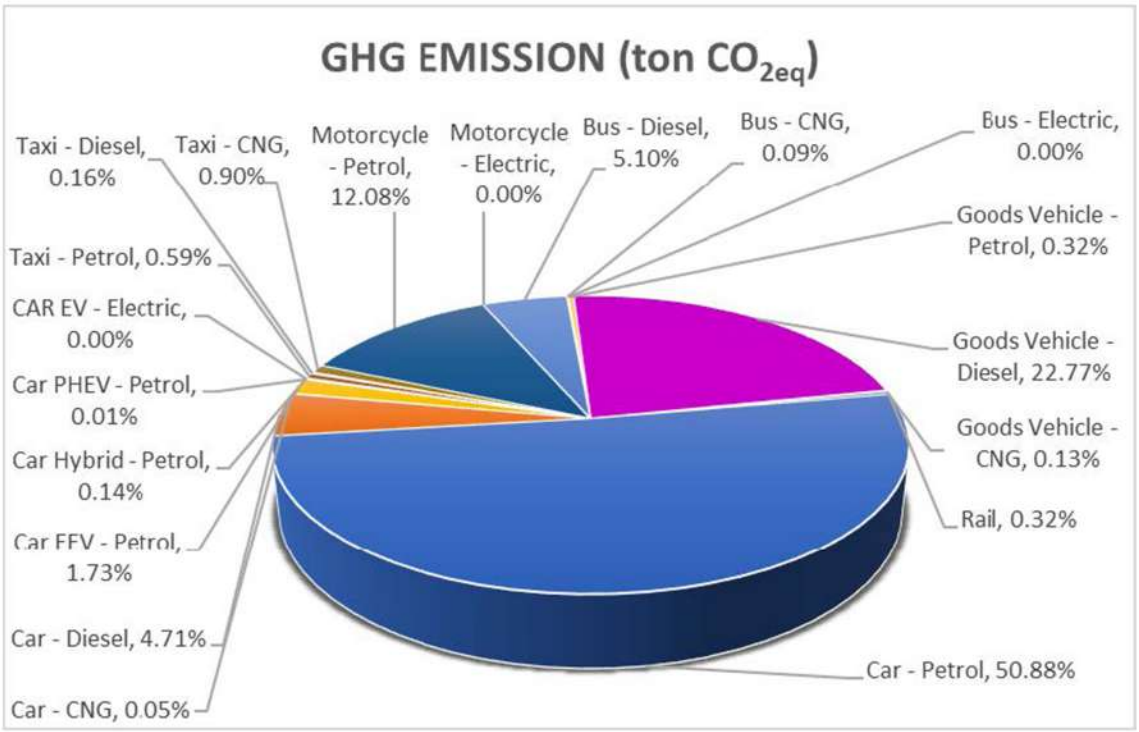


Figure 1.5: Total GHG emission for each land transport mode in 2015
Source: Calculation by study team based on *Malaysia Third National Communication and Second Biennial Update Report to the UNFCCC, MESTECC 2018*

SCENARIO 4: Transport sector final energy consumption

In 2017, Malaysia's total Final Energy Consumption (FEC) stood at 62,848 ktoe (kilo tonnes of oil equivalent), which is 9.8% higher than the previous year. The transport sector was the second fastest growing sector overall in terms of energy consumption with a total FEC of 23,522 ktoe or 37% of the country's total. Within the transportation sector, road transport dominates – accounting for more than 90% of energy consumption.

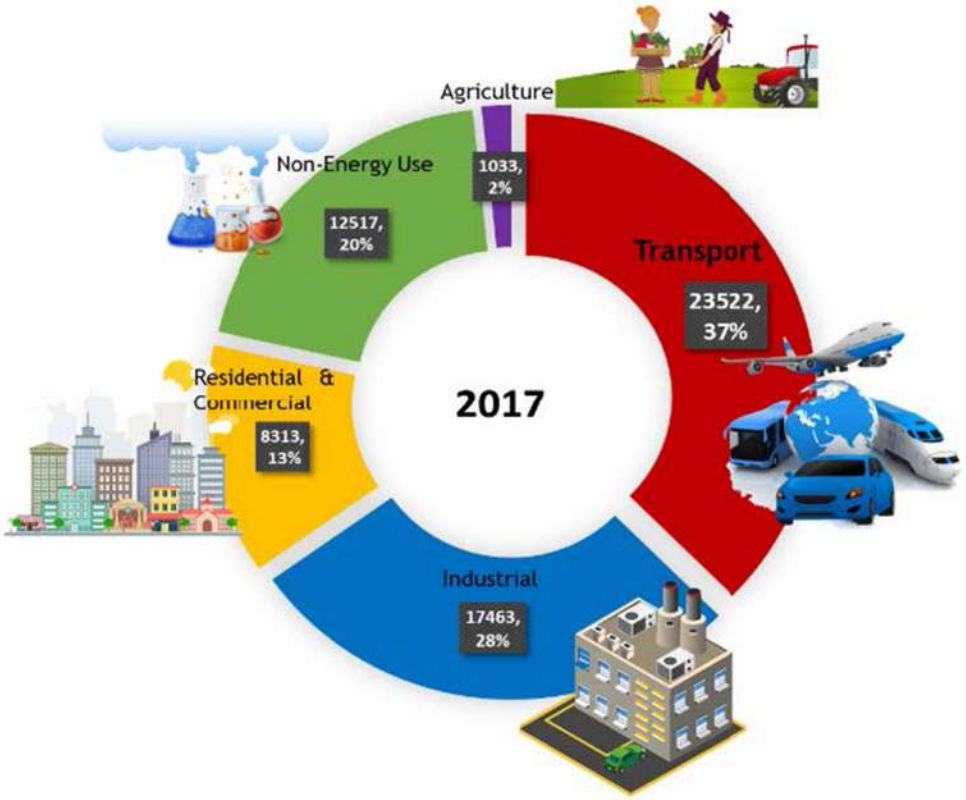


Figure 1.1: Final Energy Consumption by Sector, 2017
Source: https://meih.st.gov.my/

SCENARIO 5: Transport sector Greenhouse Gas (GHG) emission

The transportation sector also consistently remained the second largest Greenhouse Gas (GHG) emitting sector, accounting for 20% of Malaysia's total greenhouse gas (GHG) emissions in 2014 of which 18% originated from road transportation (55,366 Gg CO2eq) (NC3 BUR2).

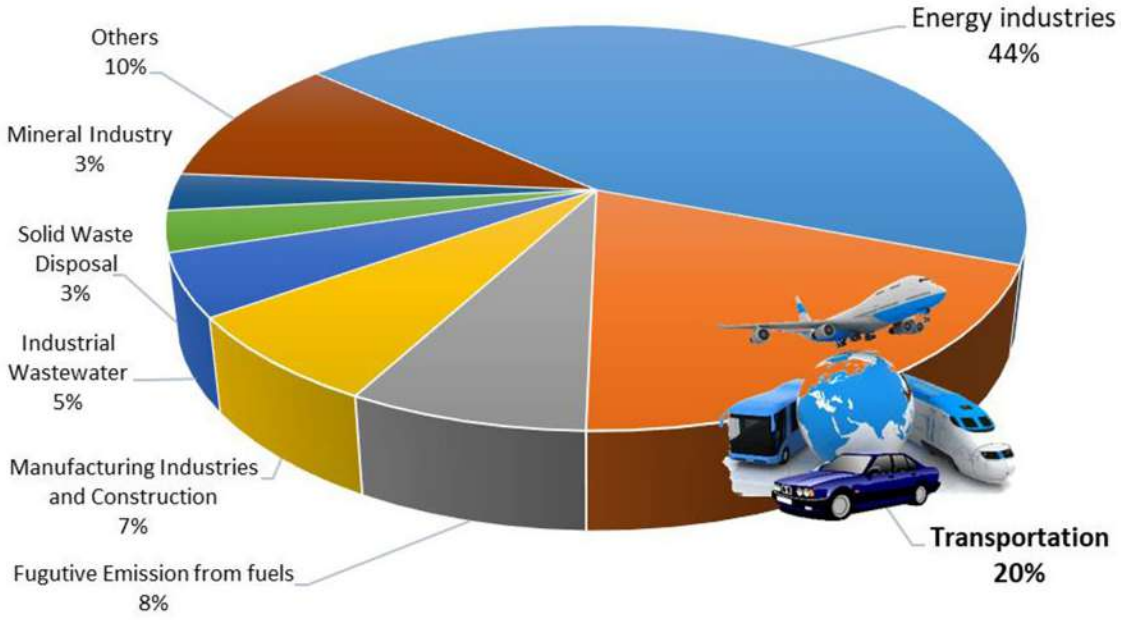


Figure 1.2: Greenhouse Gas (GHG) emission by sector, 2014
Source: Malaysia Third National Communication and Second Biennial Update Report to UNFCCC, MESTECC 2018

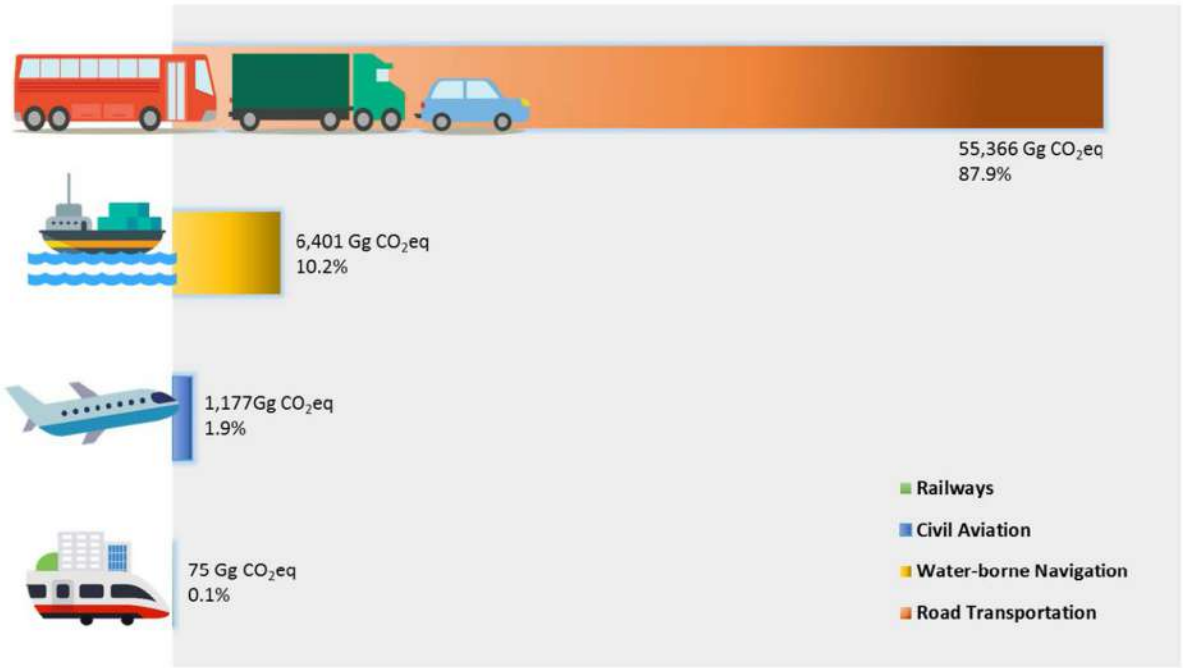


Figure 1.3: Estimate of GHG Emission by Transport Sector, 2014
Source: Malaysia Third National Communication and Second Biennial Update Report to the UNFCCC, MESTECC 2018

SCENARIO 6: Malaysia's Paris Agreement ratification

Malaysia is a party to the United Nations Framework Convention on Climate Change (UNFCCC). Consonant to the Convention, Malaysia ratified the Kyoto Protocol in 2002 and the Paris Agreement in 2016. Under the Paris Agreement, Malaysia communicated the country's Nationally Determined Contributions (NDC) intending to reduce 45% GDP emissions intensity by 2030 relative to the emissions intensity in base year 2005. This consists of a 35% reduction on an unconditional basis and a further 10% conditional upon receipt of climate finance, technology transfer and capacity building from developed countries.

Kyoto Protocol 2002 and the Paris Agrement 2016

Ratification by Malaysia:

Malaysia communicated the country's Nationally Determined Contributions (NDC)

Intending to reduce

45%

GDP emission intensity by 2030 relative to the emission intensity in base year 2005

FOCUS AREA

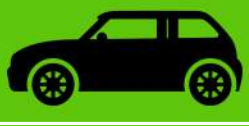
A

GREENHOUSE GAS EMISSION & ENERGY REDUCTION VIA

VEHICLE FUEL ECONOMY & EMISSION IMPROVEMENT

2 strategies and 10 action plans have been identified

2 STRATEGIES



Encouraging Adoption of Low Emission Vehicles (for both Light Duty Vehicle (LDV) and Heavy Duty Vehicle (HDV))

Strengthen Energy Efficient Driving Program (for both Light Duty Vehicle (LDV) and Heavy Duty Vehicle (HDV))

ACTION PLANS

- Establish national GHG (greenhouse gas) emission limit and FE (fuel economy) target for new vehicles and align to ASEAN and Global Fuel Efficiency Initiatives (GFEI)
- Explore compulsory exhaust emission rating for vehicle type approval (VTA)
- Implementing GHG emission & FE labelling as part of informed purchase decision approach
- Improving regulations and incentives on engine emission level for new vehicles
- Explore compulsory vehicle inspection and end-of-life regulations
- Implementing Green Logistic (Freight and Goods Vehicles) Programme
- Improve regulation and incentives on engine emission level for new vehicles (HDV) and rebuild vehicles
- Improve low carbon emission requirement in inspection regulation and explore end-of-life for HDV and rebuild HDV

- Implement eco-driving programme for private vehicle drivers
- Implement eco-driving programme for commercial drivers (trucks, buses, goods vehicles)

Strategy 1:
Encouraging Adoption of Low Emission Vehicles

This strategy falls within the focus area of GHG emission and energy reduction via vehicle fuel economy and emission improvement.

In the analysis performed on vehicle fuel consumption, it was found that there is a significant gap between the average fuel consumption of passenger vehicles in the country compared to the ASEAN Fuel Economy Roadmap target and Global Fuel Efficiency Initiatives (GFEI) best practices. The aim is to gradually reduce the gap and align to international best practices at a later phase. The indicators are the average fuel economy and GHG emission per km on new vehicles on the road and the national average of total vehicles on the road. The implementation will include the setting up of an ecosystem and MRV for reporting purposes.

For the strategy to be successful, all aspects need to be simultaneously addressed. Regulations on vehicle being allowed to enter the market and run on the road need to incorporate carbon emission criteria. Vehicle manufacturers need to be incentivised to produce vehicles that emits lower emission level. Road users need to be educated and informed to enable them to make an informed purchasing decision when purchasing a vehicle, as well as encouraged to ensure vehicle fitness, including in term of vehicle emission level, during the life of their vehicle. Vehicle no longer fit for road use may need to be dealt with in the best possible way.

Analysis shows that goods vehicles impact on energy consumption and CO2 is very high relative to its inventory. Relative to other vehicles, goods vehicles have low VKT but consume a significant percentage of total energy consumption and emit a significant percentage of total GHG emission. One segment that need to be more visible in term of regulations is the rebuild vehicles, as it can contribute towards significant GHG emission.

Strategy 2:
Strenghten Eco Driving Program

This strategy is the second strategy within the focus area of GHG emission & energy reduction via vehicle fuel economy and emission improvement.

Another important initiative is eco driving. Studies have shown that energy efficient driving (sometimes referred to as eco-driving) can significantly help reduce energy consumption and, hence, reduce GHG emissions. The aim is to have the maximum possible number of private and commercial vehicle drivers practise energy efficient driving thereby reducing GHG emission. The strategy includes training for drivers; enforcement (where possible for private and commercial vehicle drivers) and communication; and marketing and branding (for private vehicle drivers). Implementation of a green freight programme will showcase business eco driving adoption and best practices.

Action Plan 1.1

Establishing a national GHG emission limit (and FE) target for new vehicles and aligning to ASEAN and Global Fuel Efficiency Initiatives (GFEI)

Light duty vehicles make up a significant portion of vehicles on Malaysian roads. They are responsible for more than 50% of GHG emission of land transport. With the number of vehicles expected to increase, the country needs a more aggressive national target for GHG emission level for cars sold each year to meet the ASEAN target by 2026, and eventually, the Global Fuel Efficiency Initiatives (GFEI) by 2030. The action plan calls for gradual improvement towards both national average for FE and CO_2.

Objectives

1. To establish a national GHG emission limit (and FE) target for new vehicles and aligning to ASEAN and Global Fuel Efficiency Initiatives (GFEI).

Action items

- 2021: Focusing on light duty vehicles to establish national target
- 2021-2023: National target of 144 gCO2/km (equivalent to 6.2 L/100km) for passenger vehicles.
- 2024-2026: National target of 123 gCO2/km (equivalent to 5.3 L/100km) for passenger vehicles.
- 2027-2030: National target of 95 gCO2/km (equivalent to 4.1 L/100km) for passenger vehicles.

Action Plan 1.2

Explore compulsory exhaust emission rating for vehicle type approval (VTA)

One strategic aspect in moving towards the achievement of the national GHG emission limit target is the VTA process to include the consideration of vehicle exhaust emission rating. Vehicle Type Approval (VTA) process ensure only road-worthy vehicles are on Malaysian road. VTA also validating all the requirement set by Standards are being adhered to. Although exhaust emission is part of the standard, VTA Malaysia have yet to include this as the mandatory passing item.

Objectives

1. Explore a compulsory consideration of exhaust emission rating in Vehicle Type Approval (VTA).
2. To have KASA or its relevant agency be in the VTA committee.

Action items

- 2021: Inclusion of exhaust emission as part of VTA requirement. Validated figures to be used for the emission and FE performance indicator of the vehicles.
- 2021 onwards: Revision of FE and CO2 emission standards to be accordance to the to be decided test cycles.

Action Plan 1.3

Implementing GHG emission & FE labelling as part of informed purchase decision approach

GHG emission & FE labelling would serve as means for education and awareness for car buyers on emission level and fuel economy of cars, and may result in better decision making for car buyers in selecting vehicles with better fuel economy and emission level. GHG emission & FE labelling should be implemented as soon as possible using the driving cycle currently used for FE and GHG emission determination. Afterwards, labelling can adopt the new driving cycle when it comes into effect. The values are to be validated by VTA and made compulsory for both new vehicle registration and used and grey imports.

Objectives

1. To implement GHG emission & FE labelling as part of informed purchase decision approach.

Action items

1.3 A: Institute requirement to show GHG emission, FE, and potential savings at point of sales.

a. Introduce the best GHG emission & FE labelling to incorporate emission level, fuel economy and potential savings and other aspects such as safety (2021).
b. Implement GHG emission & FE labelling (with current driving cycle; i.e., the New European Driving Cycle (NEDC) (2021 onwards).
c. Adopt Worldwide Harmonised Light Vehicle Test Procedure (WLTP) driving cycle for GHG emission & FE labelling (2024 onwards).

Action Plan 1.4

Improving regulations and incentives on engine emission level for new vehicles

Regulation on vehicle engine emission level is one crucial way to ensure that the targeted emission level is met by all new vehicles. The Disel Hijau incentive scheme should be updated to encourage opting for higher standards (than the minimum requirement).

Objectives

1. To improve regulations on engine emission level for new vehicles.
2. To improve incentives on engine emission level for new vehicles.

Action items

1.4 A: Update regulations of Euro emission standard for new petrol vehicles.

a. Update regulations requiring new vehicles meet Euro 4 requirements for all petrol engine vehicles in 2021.
b. Update regulations requiring new vehicles meet Euro 5 requirements for all petrol engine vehicles in 2026.
c. Update regulations requiring new vehicles meet Euro 6 requirements for all petrol engine vehicles in 2030.

1.4 B: Update regulation of Euro emission standard for new diesel vehicles.

a. Update regulations requiring new vehicles meet Euro 4 requirements for all diesel engine vehicles in 2021.
b. Update regulations requiring new vehicles meet Euro 5 requirements for all diesel engine vehicles in 2026.
c. Update regulations requiring new vehicles meet Euro 6 requirements for all diesel engine vehicles in 2030.

1.4 C: Update Euro emission standard for engine certification in Disel Hijau scheme.

a. Update Disel Hijau scheme to Euro 5 engine standard (2021).
b. Update Disel Hijau scheme to Euro 6 engine standard (2026).

Action Plan 1.5 & 1.6

Explore compulsory vehicle inspection and end-of-life regulations

Poorly maintained vehicle can be one cause for poor emission level. A good vehicle inspection policy can be a significant factor to raise awareness as well as implementation of good vehicle maintenance, while at the same time eliminate vehicle with bad emission level from the road.

Objectives

1. To explore compulsory vehicle inspection and end-of-life vehicle (ELV) regulations.

Action items

1.5 A: Compulsory vehicle inspection policy.
- a. Formulation of the best possible policy for vehicle inspection policy (2021-2023).
- b. Implementation of vehicle inspection policy (2024 onwards).
- c. Continuous monitoring and improvement (2024 onwards).

1.5 B: End-of-life vehicle (ELV) policy.
- a. Formulation of the best possible policy for ELV policy (2021-2023).
- b. Implementation of ELV policy (2024 onwards).
- c. Continuous monitoring and improvement (2024 onwards).

Implementing Green Logistic (Freight and Goods Vehicles) programme

Freight forwarders lack knowledge in improving energy performance conditions in the freight transport sector. The majority (more than 50%) of registered goods vehicles are 15 years old or more. Goods vehicles have a 4.4% share of total volume of vehicles but goods vehicles have the second highest GHG emissions among total transport mode.

Objectives

1. To implement Green Logistic (Freight and Goods Vehicles) programme.

Action items

1.6A: Develop Fuel Economy Baseline for freight/heavy duty vehicles.
- a. Finalisation of Energy Efficient definition for larger segment vehicles (heavy vehicles).
- b. Establish system for collecting data, benchmarking performance of green freight technologies and reporting methodologies.

1.6B: Establish national level green freight programme for businesses and industries.
- a. Promote adoption of energy saving and emission reducing strategies in freight transport.
- b. Monitor, report and verify.

1.6C: Exploring low emission vehicle technologies.
- a. Explore and evaluate various low emission vehicle technologies in freight and goods transport.
- b. Encourage for adoption of identified low emission vehicle technologies.

Action Plan 1.7

Improve regulation and incentives on engine emission level for new vehicles (HDV) and rebuild vehicles

Regulation on vehicle engine emission level is one crucial way to ensure that the targeted emission level is met by all new vehicles. The Disel Hijau incentive scheme should be updated to encourage opting for higher standards (than the minimum requirement). Rebuild vehicles can be one segment that run on the road without the same level of regulations as new vehicles, hence a study focusing on this aspect is deemed needed, and any identified improvement need to be implemented.

Objectives

1. To improve regulation and incentives on engine emission level for new vehicles.

Action items

1.7 A: Update regulation of Euro emission standard for new diesel vehicles.

a. Update regulations requiring new vehicles meet Euro 4 requirements for all diesel engine vehicles (2021).
b. Update regulations requiring new vehicles meet Euro 5 requirements for all diesel engine vehicles (2026).
c. Update regulations requiring new vehicles meet Euro 6 requirements for all diesel engine vehicles (2030).

1.7 B: Update Euro emission standard for engine certification in Disel Hijau scheme.

a. Update Disel Hijau scheme to Euro 5 engine standard (2021).
b. Update Disel Hijau scheme to Euro 6 engine standard (2026).

1.7 C: Improve regulation for rebuild vehicles.

a. Formulation of necessary improvement on regulation for rebuild vehicles (2021).
b. Implementation of improved regulation (2024).

Action Plan 1.8

Improve low carbon emission requirement in inspection regulation and explore end-of-life for HDV and rebuild HDV

Poorly maintained vehicle can be one cause for poor emission level. Improvement of low carbon emission in HDV inspection regulations can be a significant factor to ensure implementation of good vehicle maintenance, while at the same time eliminate vehicle with bad emission level from the road. Vehicle no longer fit for road use need to be managed and disposed appropriately, and with no clear end-of-life vehicle policy, abandoned vehicles which becomes hazard becomes one unwanted outcome.

Objectives

1. To improve low carbon emission requirement in inspection regulation and explore end-of-life for HDV and rebuild HDV.

Action items

1.8 A: Improve low carbon emission requirement in HDV inspection regulations.

a. Finalisation of the best possible policy for low carbon emission requirement in HDV inspection regulations (2021-2023).
b. Implementation of improvement in HDV inspection regulations (2024 onwards).
c. Continuous monitoring and improvement (2024 onwards).

1.8 B: End-of-life vehicle (ELV) policy for HDV and rebuild HDV.

a. Development of the best possible policy for ELV policy for HDV and rebuild HDV (2021-2023).
b. Implementation of ELV policy for HDV and rebuild HDV (2024 onwards).
c. Continuous monitoring and improvement (2024 onwards).

Action Plan 2.1

Implement eco-driving programme for private vehicle drivers

Training increases driver awareness and understanding. This helps them drive in ways that improve fuel efficiency. Driver campaigns that focus on cost savings, traffic safety and relaxed driving have been proven superior as opposed to ones that focus on the environment or CO2 emission reduction. This is exemplified by Netherlands' successful eco-driving campaigns of the same. Improved fuel efficiency means less GHG emissions.

Objectives

1. To introduce eco-driving component in new driver's training course to obtain driving license.
2. To establish communication, marketing and branding.

Action items

2.1 A: Introduce eco-driving component in new driver training course to obtain driving license.

a. Formulation of eco-driving implementation program (2021-2022).
b. Implement eco-driving component in new driver training course (2023 onwards).

2.1 B: Implement communication, marketing, and branding.

a. Devise concept of campaign to be launched (2021-2022).
b. Deploy TV and radio commercials, print, information desk and supporting activities (2023 onwards).
.

Action Plan 2.2

Implement eco-driving programme for commercial drivers (trucks, buses, goods vehicles)

Driving behaviour is identified as one significant factor that can improve fuel efficiency and emission level. Highly inefficient and/or aggressive driving behaviour also led to accident and death. Training increases driver awareness and understanding. This helps them drive in ways that improve fuel efficiency as well as safety. Improved fuel efficiency means less GHG emissions.

Objectives

1. To make mandatory eco-driving training for commercial drivers.
2. To enforce driver monitoring system on commercial vehicle drivers.

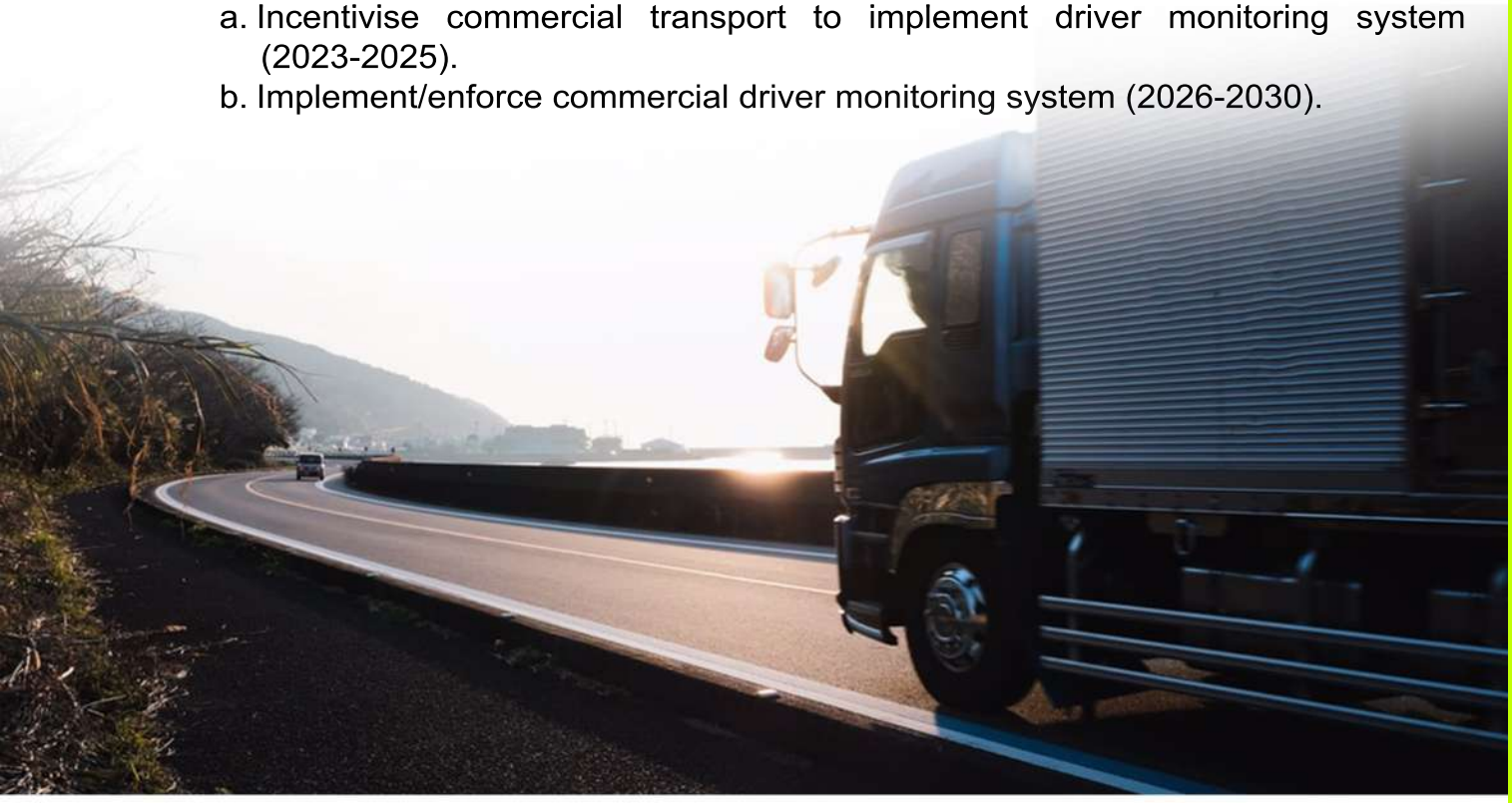
Action items

2.2 A: Introduce eco-driving training requirement for commercial drivers.

a. Engage with stakeholders of commercial driver training (2021-2022).
b. Implement regular eco-driving programmes (2021-2025).
c. Institute eco-driving requirement for all drivers (2026 onwards).

2.2 B: Enforce driver monitoring system on commercial vehicle drivers.

a. Incentivise commercial transport to implement driver monitoring system (2023-2025).
b. Implement/enforce commercial driver monitoring system (2026-2030).



FOCUS AREA

B

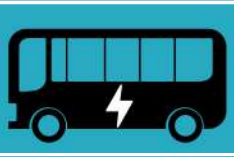
GREENHOUSE GAS EMISSION & ENERGY REDUCTION VIA

ELECTRIC VEHICLE ADOPTION

1 strategy and 13 action plans have been identified

3 SUB-STRATEGIES

(i): Adopting Electric Mobility in Strategic Applications – Electric Car Adoption



(ii): Adopting Electric Mobility in Strategic Applications – Electric Bus Adoption

(iii): Adopting Electric Mobility in Strategic Applications – Electric Motorcycle Adoption

ACTION PLANS

- Government lead by example
- Adopt EV cars for taxi fleet as part of taxi service mod -ernisation and rebranding
- Provide EV incentives for the market
- Ensure EV charging infras -tructure sufficient for private EV penetration
- Provide R&D grants and support to manufacturers of local EV cars
- Building a holistic EV ecosystem

- Establish e-bus central procurement agency
- Public transport electricity tariff and electricity subsidy
- Providing support to manufacturers of local EV bus

- Procure electric motorcycles for government enforcement fleet
- Use electric motorcycles for delivery service
- Development of battery swapping standard for electric motorcycles in Malaysia
- Provide support to manufacturers of local electric motorcycles

Strategy 3 (i):
Adopting Electric Mobility in Strategic Applications – Electric Car Adoption

This strategy is part of the focus area of GHG emission and energy reduction via electric mobility adoption.

The assessment of current inventory and vehicle technologies indicates electric cars provide significant energy savings and GHG reduction. Hence, electric cars provide a great alternative for significant GHG emission reduction for land transport provided that GHG emissions from the electricity sector will continue to emit the same or less amount in the years to come.

The cost for this technology is very much related to global EV battery prices. The battery price is on a steady drop; however, the focus of OEMs at the moment is to lengthen battery life so that the charge cycle is reduced. Thus, cost of cars is not reducing but rather battery capacity is increasing. When optimum capacity of the battery is achieved, it is expected that vehicle cost to be reduced and price parity will eventually occur.

The long-term success and sustainability of this strategy need to include local manufacturing, maintenance capacity and infrastructure readiness. Ensuring EV charging infrastructure readiness and supporting local EV manufacturers are part of this strategy. The strategy focuses on increasing EV penetration rate with a roadmap that increases the natural competitiveness of EV. Some government-led adoption is needed for mass volume creation to kickstart and enable a workable business model for local EV manufacturing and maintenance. EV adoption as part of taxi service modernisation and rebranding is also included as part of the strategy.

For mass adoption of EV, PHEV (plug-in hybrid electric vehicles) is considered a transition technology moving towards full BEV (battery electric vehicles). This will be reflected by the targets of PHEV and BEV over the course of the short-term, medium-term, and long-term implementation phases.

Strategy 3 (ii):
Adopting Electric Mobility in Strategic Applications – Electric Bus Adoption

This strategy is part of the focus area of GHG emission and energy reduction via electric mobility adoption.

The assessment of current inventory and vehicle technologies indicates that electric buses provide significant energy saving and GHG reduction (48% reduction compared to diesel buses). Hence, electric buses provide a great alternative for significant GHG emission reduction.

The majority of current buses run on subsidised diesel price. Based on the modal share target, the number of buses needs to be increased about 3-4 times the current fleet size. Diesel buses produce high emission and harmful gases. The electric bus, on the other hand, is highly recommended because it significantly reduces GHG emission and, at the same time, produces zero tailpipe discharge.

Strategy 3 (iii):
Adopting Electric Mobility in Strategic Applications – Electric Motorcycle Adoption

This strategy is part of the focus area of GHG emission and energy reduction via electric mobility adoption.

The motorcycle is the most efficient mode for personal motorised transport. Motorcycles have high VKT (42%) but consume only 12.3% of total energy and emit 12.4% of total GHG emission. This makes the motorcycle an attractive option for low carbon mobility. In terms of GHG emissions per passenger-km, the electric motorcycle (24.82 gCO2eq/ passenger-km) is much cleaner than the petrol car (140.82 gCO2eq/ passenger-km).

It needs to be pointed out that electric motorcycles can significantly lower both energy consumption and GHG emission of motorcycles compared to petrol ones. Energy consumption by a petrol motorcycle is about 1.65x10-6 ktoe/100km while that of an electric motorcycle is about 0.35x10-6 ktoe/100km. GHG emission for a petrol motorcycle is about 60 gCO2eq/km whereas an electric motorcycle gives out 27 gCO2eq/km. Given the large number of motorcycles in the country, electric motorcycles certainly provide great potential to lowering GHG emission of land transport.

One common concern about motorcycles is safety. A large percentage of road accidents involves motorcycles. Nevertheless, based on the country's motorcycle fatality data, most of fatalities occur in rural areas with only 8% recorded in cities. Hence, promoting electric motorcycle adoption, in particular, for urban usage should be considered.

Action Plan 3.1

Government lead by example

Adoption of EV in government and GLC fleets can be considered low hanging fruit compared to EV adoption by private vehicle users. Adoption of EV in these fleets will work as catalysts for wider adoption. Significant EV adoption will kickstart market acceptance and develop a workable business model for EV local manufacturing. EVs in government and GLC fleets can also become road advertisements for EV usage.

Objectives

1. To establish EV procurement for government fleet via open tender.
2. To establish EV procurement for GLC fleet.

Action items

3.1 A: Establish EV procurement for government fleet via open tender.

a. Implement EV procurement for government fleet (2021 – 2030).
b. Create additional scoring for local content (2021 – 2025).
c. Establish 10% target of new government fleet to be BEV (2022).
d. Establish 50% target of new government fleet to be BEV (2023 – 2025).
e. Establish local product qualification for tender participation (2025 – 2030).

3.1 B: Establish EV procurement for GLC fleet.

a. Provide tax incentives under Green Investment Technology Assets (GITA) scheme for purchase of Green Technology Assets until 2030.
b. Establish 20% target of new GLC fleet to be BEV (2023 – 2025).
c. Establish 50% target of new GLC fleet to be locally manufactured BEV (2026 – 2030).

Action Plan 3.2

Adopt EV cars for taxi fleet as part of taxi service modernisation and rebranding

Taxis can be a catalyst for EV adoption and advertisements for EV usage.

Objectives

1. To establish EV procurement for taxi fleet.

Action items

3.2 A: Establish EV procurement for taxi fleet.
Provide incentives for EV purchase of taxis and income tax exemptions to offset higher capital cost of electric vehicle (2022-2030).

Action Plan 3.3

Provide EV incentives for the market

Incentives are needed to bridge the price gap, build market trust and catalyse local manufacturing. The incentives are structured by considering PHEV as a transition technology leading to full BEV.

Objectives

1. To establish BEV-specific incentives.
2. To establish PHEV-specific incentives.

Action items

3.3 A: BEV-specific incentives

a. Provide tax incentives (reducing) to bridge price gap, build market trust and catalyse local manufacturing.

- BEV CBU Excise Duty and Import Tax Exemption (max 10,000 volume total) (2021-2022)
- 50% import duty and excise duty exemption (2023-2025)

3.3 B: PHEV-specific incentives

a. Provide tax exemption for qualified CKD PHEV.

- 100% exemption (2021-2022)
- 75% exemption (2023-2025)
- 50% exemption (2026-2030)

b. Establish qualifications based on electric range per charge and no engine charging.

- >30km at NEDC (2021-2022)
- >55km at NEDC (2023-2024)
- >75km at WLTP (2025-2027)
- >100km at WLTP (2028-2030)

c. Provide PHEV support for EV charging infrastructure development fund.

- RM5,000 per PHEV (2021-2025)
- RM3,000 per PHEV (2026-2030)

Action Plan 3.4

Ensure EV charging infrastructure sufficient for private EV penetration

Private operators are responsible to install charging facilities especially along major highways outside of urban centres. EV charging units that are solar-powered and self-contained are preferable. They will not require expensive electrical upgrades, disruptive trenching or new foundations. Installation and maintenance of fast charging outlets not covered by private operators will be financed by an EV Development Fund and managed by chargEV. All new residential structures, both single family and multifamily will have to be EV-ready. Time and costs for installing EV infrastructure are expected to be minimal

Objectives

1. To establish national target for EV charging infrastructure.
2. To facilitate private EV charging operators.
3. To provide EV charging infrastructure in areas not serviced by private operators.
4. To Incorporate requirement for installing EV charging facility in planning permission for all new buildings.
5. To provide tariff revision for EV car public charger.
6. To conduct study on advanced EV charging technologies.

Action items

3.4 A: Establish a national target for EV charging infrastructure.

- a. Establish a national target of 9000 AC charging points and 1000 DC charging points by 2025.

3.4 B: Facilitate private EV charging operators.

- a. Establish Government funding for 2000 AC charging points and 300 DC charging points as an immediate phase (2021-2022).
- b. Initiate public tender for a national fast charging network (2023-2025).
- c. Provide tax incentives under Green Income Tax Exemption (GITE) for Services until 2030.

3.4 C: Provide EV charging infrastructure in areas not serviced by private operators.

- a. Ensure fast charger installation for every 100 km and at every R&R stops along major highways (2023-2025).

3.4 D: Incorporate requirement for installing EV charging facility in planning permission for all new buildings.

- a. Establish requirement guidelines for incorporation of EV charging facilities for new buildings subject to minimum criteria (2021-2022).

3.4 E: Provide tariff revision for EV car public charger.

- a. Conduct specific tariff study and categorisation for public charging facilities set up for operators and users (2022).
- b. Conduct specific tariff implementation for public charging facilities (2022).

3.4 F: Conduct study on advanced EV charging technologies.

- a. Carry out feasibility study on advanced charging technologies (e.g. wireless, ultrafast charger, V2G and smart charging).
- b. Demonstrate advanced charging technologies (e.g. wireless, ultrafast charger, V2G and smart charging).

Action Plan 3.5

Provide R&D grants and support to manufacturers of local EV cars

If local manufacturers of EV can grow, the spillover effect will help the growth of industries surrounding the technology. This will help a lot in terms of maintenance and repair capabilities in the country and it will become less dependent on foreign companies for such needs. Currently, there is no dedicated tax incentive for investment in 'green' production and distribution activities, such as in EV production, biodiesel, biogas production and distribution. The scheme will help companies cope

Objectives

1. To provide support for local manufacturers of electric cars
2. To introduce a new tax incentive scheme targeted at 'green' industries.
3. To engage stakeholders and manufacturers.

Action items

a. Provide support for local manufacturers of electric cars with R&D and create business matching with investors.

b. Introduce a new tax incentive scheme targeted at 'green' industries including companies involved in production, distribution and services related to low-carbon transportation.

c. Engage stakeholders and manufacturers; provide necessary support to them; and conduct CEPA to apply for incentives under GTFS and other schemes.

Action Plan 3.6

Building a holistic EV ecosystem

The EV ecosystem is an interplay of several sectors and stakeholders. It is imperative for these stakeholders to come together to drive EV adoption. In addition, the government needs to consider building a holistic EV ecosystem while developing regulatory agenda.

Objectives

1. To establish a holistic EV ecosystem in Malaysia.

Action items

a. Consider a holistic EV ecosystem while developing regulatory agenda.

b. Establish a holistic EV ecosystem.

c. Further develop EV ecosystem towards maturity.

Action Plan 3.7

Establish e-bus central procurement agency

Adoption of EV in government can be considered low hanging fruit compared to EV adoption by private sectors. EVs in government can also become advertisements for EV usage. EV adoption would result in reduction in GHG emissions especially with the increase of renewable energy in electricity generation.

Objectives

1. To establish e-bus central procurement agency.

Action items

a. Revolving fund of RM450 million for e-bus competitive leasing.

b. Annual RM100 million fund.

c. Ministries and state government subscription to e-bus as part of government led by example.

Action Plan 3.8

Public transport electricity tariff and electricity subsidy.

High electricity cost becomes an obstacle for bus operators to adopt EV buses. Increase in EV adoption would result in reduction in GHG emissions especially with increase of renewable energy in electricity generation.

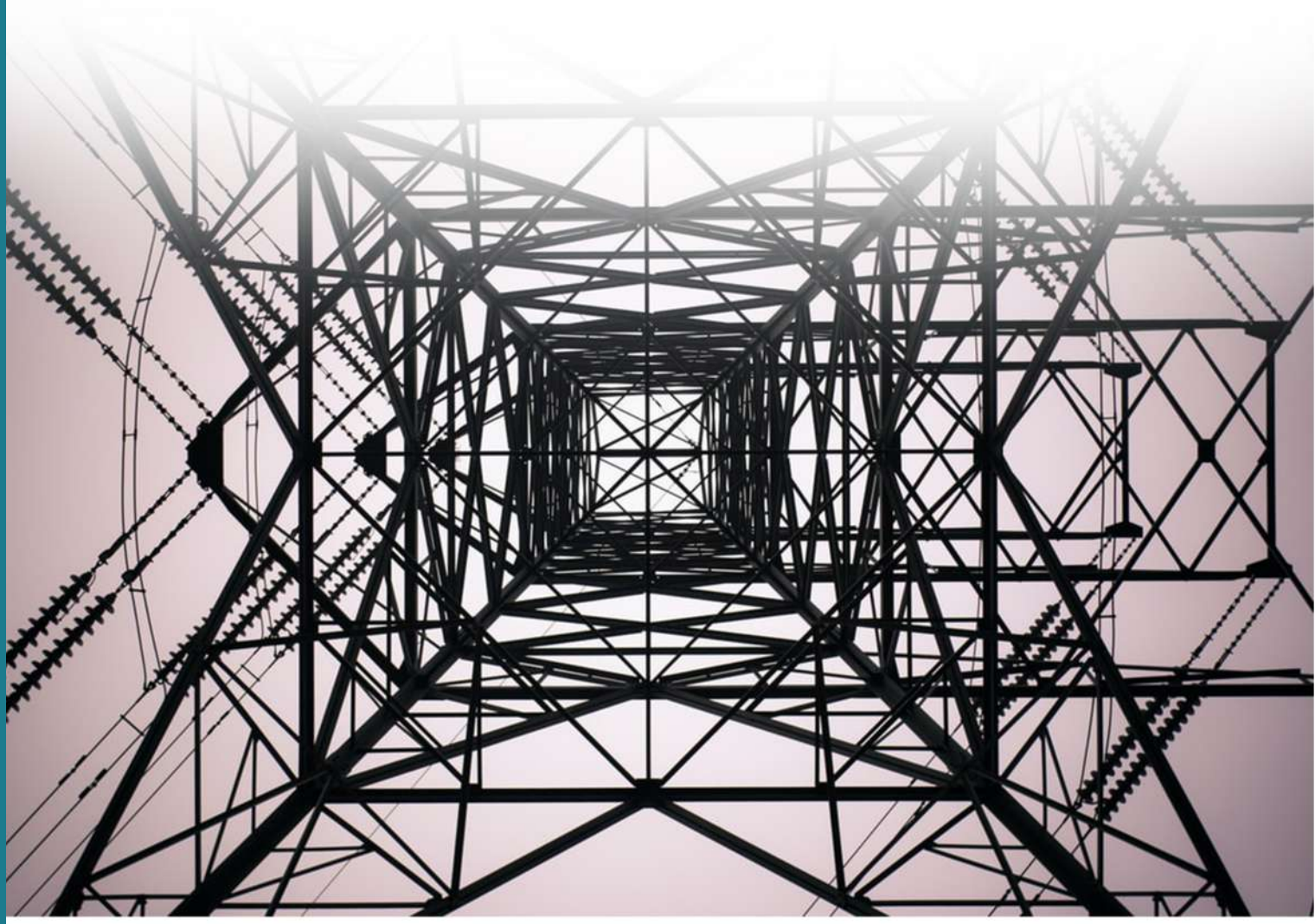
Objectives

1. To establish public transport electricity tariff and electricity subsidy.

Action items

a. Conduct specific tariff study and categorisation for bus charging facilities (2021).

b. Conduct specific tariff implementation for bus charging facilities (2022).



Action Plan 3.9

Providing support to manufacturers of local EV bus

If local manufacturers of EV can grow, the spillover effect will help the growth of industries surrounding the technology. Currently, there is no dedicated tax incentive for investment in 'green' production and distribution activities. The scheme will help companies cope with purchase of technology, raw material costs, maintenance and smaller economies of

Objectives

1. To provide support to manufacturers of local EV bus.

Action items

a. Provide support for EV bus local manufacturers with R&D and create business matching with investors.

b. Introduce a new tax incentive scheme targeted at 'green' industries including companies involved in production, distribution and services related to low-carbon transportation.

c. Engage stakeholders and manufacturers; provide necessary support to them; and conduct CEPA to apply for competitive Green Technology Financing scheme (GTFS) and other schemes.

d. Develop an electric bus roadmap.

Action Plan 3.10

Procure electric motorcycles for government enforcement fleet

Adoption of EV in government enforcement fleet can be considered low hanging fruit compared to EV adoption by private vehicle users. EV in government enforcement fleet can also become advertisements for EV usage.

Objectives

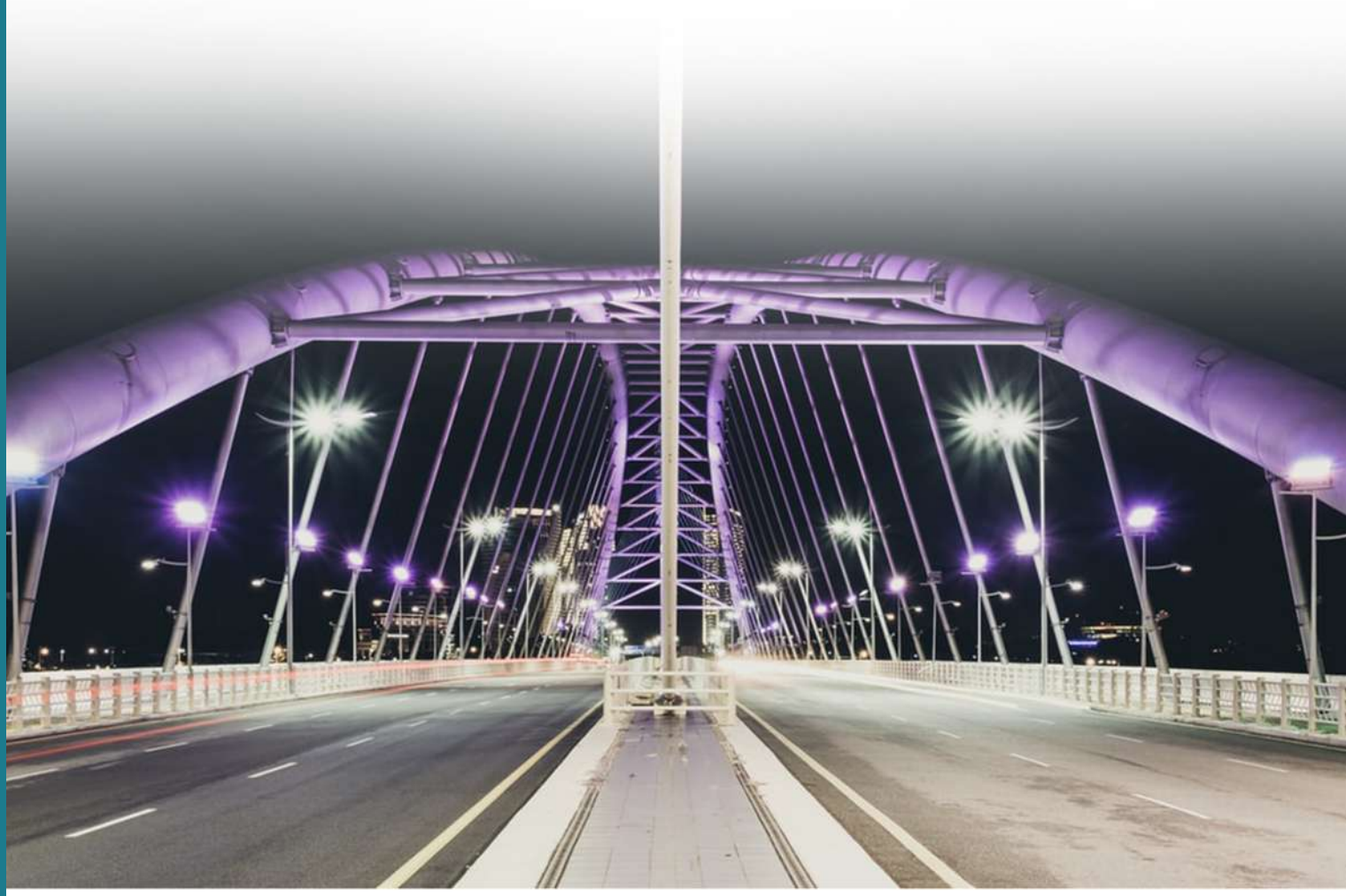
1. To procure electric motorcycles for government enforcement fleet.

Action items

a. Government lead by example.

b. EV procurement.

c. Charging infrastructure.



Action Plan 3.11

Use electric motorcycles for delivery service

Adoption of EV in delivery service fleets can be considered low hanging fruit compared to EV adoption by private vehicle users. EV in delivery service can also become advertisements for EV usage. Without any incentive in the early phase, the high capital cost may become an obstacle.

Objectives

1. To utilize electric motorcycles for delivery service.

Action items

Provide tax incentives under Green Investment Technology Assets (GITA) scheme for purchase of electric motorcycles for delivery service.

Action Plan 3.12

Development of battery swapping standard for electric motorcycles in Malaysia

Battery swapping for electric motorcycles is one viable option to fulfil recharge needs of electric motorcycles efficiently. Unlike for cars where standards and regulations are more established, the standards and regulations for electric motorcycles need to be established.

Objectives

1. To develop battery swapping standard for electric motorcycles in Malaysia

Action items

a. Conduct study on battery swapping ecosystem (2022).

b. Implement battery swapping system (2024).

Action Plan 3.13

Provide support to manufacturers of local electric motorcycles

If local manufacturers of EV can grow, the spill over effect will help the growth of industries surrounding the technology. Currently, there is no dedicated tax incentive for investment in 'green' production and distribution activities. The scheme will help companies cope with purchase of technology, raw material costs, maintenance and smaller economies of scale.

Objectives

1. To provide support to manufacturers of local electric motorcycles.

Action items

a. Provide support to local manufacturers of electric motorcycles with R&D and create business matching with investors.

b. Introduce a new tax incentive scheme targeted at 'green' industries including companies involved in production, distribution and services related to low-carbon transportation.

c. Engage stakeholders and manufacturers, provide necessary support and conduct CEPA to apply for competitive Green Technology Financing scheme (GTFS) and other schemes.

FOCUS AREA

C

GREENHOUSE GAS EMISSION & ENERGY REDUCTION VIA

ALTERNATIVE FUEL ADOPTION

2 strategies and 5 action plans have been identified

2 STRATEGIES

Enhancing Use of Biodiesel in Road Transport

Creating an Eco-system for Growth of Alternative Fuel and Energy Industry

ACTION PLANS

Increasing use of biodiesel for diesel vehicles

Updating specifications, requirements and incentives relating to vehicle emission for new vehicles as well as rebuild diesel trucks

Providing support to alternative fuel production and distribution growth for transport sector

Developing FCEV roadmap

Reducing national electricity emission factor and enhancing renewable electricity sources

Strategy 4:
Enhancing Use of Biodiesel in Road Transport

This strategy is part of the focus area of GHG emission and energy reduction via alternative fuel adoption.

Higher biodiesel blends will have lower GHG emission than lower blends. A life cycle analysis conducted by the Argonne National Laboratory found that emissions for 100% biodiesel (B100) are 74% lower than those from petroleum diesel. Recently, the California Air Resources Board reported similar values for its life-cycle analysis of biodiesel from various sources (AFDC, US).

Goods vehicle population in 2018 was approximately 1.3 million of freight vehicles (or heavy goods vehicles). For vehicles of 4000cc – 6000cc, they amount to 26% of total, and those above 6000cc, 24%. In recent years, new registration of freight vehicles has fluctuated around 30,000 new registrations each year. A vast majority of goods vehicles run on diesel (76%). A total of 57.1% is certified as “disel hijau” while another 18.9% have diesel engines not certified as such. The diesel goods vehicle segment is an important segment as its GHG emissions amount to 22.7% of total GHG emissions although they number only 4.4% of total vehicle population in the land transport sector.

Strategy 5:
Creating an Eco-system for Growth of Alternative Fuel and Energy Industry

This strategy is part of the focus area of GHG emission and energy reduction via alternative fuel adoption.

Natural gas is safer than gasoline in many respects (Kowalewiez, 1984). It is also cleaner than either gasoline or diesel as far as emissions are concerned. Other benefits include resource availability; environmental compatibility; lower operating costs; and conventional diesel and gasoline engine usability. Although it is challenging to run CNG in non-optimised petrol or diesel engines, it is a great fuel if a proper gas engine is used. The adoption of CNG in vehicles can bring the emission level to Euro 6 standard which is very good for human health. In terms of native gas engine vehicle adoption, it may be easier to project adoption in bus or goods vehicle fleet versus private vehicles.

Biogas obtained from oil palm mills or landfills has the potential to significantly contribute towards reduction of total GHG emission and has the capacity to be produced locally. In fuel terms, the property of biogas is the same as CNG; hence, the adoption of biogas into NGV engines is seamless as no retrofitting is required. Methane migration into the atmosphere is significantly harmful in the context of GHG. Capturing methane gas and using biogas to power vehicles have a huge positive impact in nett national GHG emission.

Potential biogas adoption that can be looked into is the injection of biogas into the gas pipeline. This will introduce and increase the renewable mix in gas supply. Biogas can also be used in any local vehicle application, for instance, stage buses. In the case of NGV buses running on 100% biogas, it is effectively the best for GHG emission as the fuel is totally renewable.

Liquefied Petroleum Gas (LPG) is a mixture of Butane and Propane, and it comes from natural gas processing and crude oil refining. It is a colourless and odourless gas, and ethyl mercaptan is added to give it a strong smell to enable detection of any leakages. LPG has the lowest greenhouse gas emissions than other (fossil) fuels. This sulphur free emission produces no smoke, no soot and does not have any un-burnt carbon particles. It is also considered as a safe fuel, as LPG burns only if the proportion of LPG is between 1.8% and 9.5% in the LPG-air mixture. With leaner or richer mixture, it may not even burn.

In 2017 Toyota JPN taxi was introduced in the run up to the 2020 Olympic Games. It is an LPG hybrid taxi, which uses LPG and electric drivetrain to achieve 19.4 km/l fuel economy (on the Japanese JC08 cycle). By mid-2020 it is expected that JPN taxi will account for about one-third of the Tokyo fleet. However, the LPG taxi cost almost a third more than the model it replaces (note: due to several factors including the design of the taxi). Government subsidies are giving taxi firms incentives to buy the vehicles; however, the subsidies will disappear once Olympics ended. The application of LPG hybrid as taxi in Tokyo is an interesting case study, and it may be best to observe the development after the 2020 Olympics Games ended to formulate the best strategy for any application of LPG vehicle in Malaysia.

If mass adoption is a target, the success of Turkey that achieve the highest percentage of LPG vehicles in the world can be linked to the Turkish government's application of high taxes upon petrol and diesel prices, leading towards converting vehicles into LPG vehicles producing advantage of 35% to 40% savings.

Hydrogen is a viable alternative fuel source to fossil fuels and was introduced in the Eighth Malaysia Plan. Hydrogen is an odourless and colourless gas in pure form. It is an energy carrier, like electricity, and not an energy source. Therefore, it does not produce energy but can be used to store and deliver energy that is later converted to usable forms.

Hydrogen acts as fuel in power generation or transport by utilising fuel cells. Widespread use of hydrogen as a clean energy carrier can potentially be a real solution to problems regarding climate change such as global warming, carbon emission and energy security. As for the hydrogen fuel cell bus, three hydrogen buses are currently in its reliability run and will be tested as part of the pilot project for hydrogen vehicles in Kuching, Sarawak.

As the governments of Japan and South Korea have made hydrogen-based transportation central to their energy, these two markets become target markets for hydrogen exporters. Australia was reported to be aiming to expand exports of hydrogen to Japan, while also identified South Korea as a promising market for Australian hydrogen. These promising markets for green hydrogen may also be a part of the strategy of hydrogen production project in Sarawak.

One challenge for the hydrogen economy is to bring the cost down for hydrogen production. Japan have specified in their strategy towards being carbon-neutral of cutting the cost of producing carbon dioxide-free hydrogen to less than a tenth of current level by 2050. The International Energy Agency (IEA) mentioned that the cost of producing hydrogen from renewable energy could fall, but warned about major challenges such as slow development of infrastructure and regulatory hurdles. A lack of refuelling stations, which are costly to build, in turn becomes the biggest obstacle to widespread adoption of hydrogen fuel cell vehicles (FCVs). Additionally, there is the cost of the vehicle itself, which is significantly higher than the ICE counterpart even with significant subsidies. However, automakers contend that once sales volumes increase, economies of scale will make subsidies unnecessary.

In consideration of the whole land transport eco-system, one possible factor behind the reluctance in shifting from fossil fuels to alternative fuels and energy sources in the country is the relatively low price of petrol and diesel fuel. The higher prices of these fuels in other countries open the field for green alternative fuels to contend financially in the market. Conversely, it is very difficult for any green alternative fuel to compete in the market given the current low price of petrol and diesel fuel here. At the same time, low prices reward those who consume more fuel resulting in increased pollution. With a subsidised fuel regime, those who consume more would be the beneficiaries of the subsidy compared to those of the lower income group who tend to have smaller vehicles. A more effective mechanism should be considered to benefit the environment and at the same time avoid burdening the lower income group.

With EV expected to have increase in adoption with time, one energy industry that is significant towards achieving the target of low carbon mobility is the electric power industry. With the emission factor of electricity directly affect the total carbon emission of EV, a national target emission factor level should be identified, on top of renewable energy electricity generation target.

Action Plan 4.1

Increasing use of biodiesel for diesel vehicles

Increasing the biodiesel portion in blends will improve emission levels of diesel vehicles. To increase overall biodiesel adoption, two approaches are available:
a. Enforce B30 for all diesel vehicles, or
b. Implement B100 for specified vehicles, such as city buses.

Objectives

1. To implement higher biodiesel blends for diesel vehicles.
2. To conduct Communication, Education and Public Awareness (CEPA) in partnership with OEMs to promote use of biodiesel.

Action items

4.1 A: Implement higher biodiesel blends for diesel vehicles.
- a. Implement B20 in 2020 (2020).
- b. Conduct in-depth study on higher biodiesel implementation: use of B30 for all diesel vehicles and use of B100 for specified vehicles (e.g. city buses) (2020-2021).
- c. Implement B30 for all diesel vehicles and/or B100 for specified vehicles (2022).

4.1 B: Conduct Communication, Education and Public Awareness (CEPA) in partnership with OEMs to promote use of biodiesel.
- a. Engage with OEMs (2020-2021).
- b. Formulate CEPA strategies (2021-2022).
- c. Implement CEPA to promote use of biodiesel (2022-2025).
- d. Require B100 buses to have advertisements promoting them as fully biodiesel

Action Plan 4.2

Updating specifications, requirements and incentives relating to vehicle emission for new vehicles as well as rebuild diesel trucks

The requirement of engine emission level is one crucial way to ensure that all new vehicles meet emission target. One issue raised, with regard to the adoption of higher biodiesel blends in diesel fuel, is the suitability of diesel vehicles. By making diesel vehicles to be FAME prepared as a standard feature of VTA requirement on diesel vehicles as well as for the rebuild trucks, all vehicles will be ready for any increase in biodiesel blend.

Objectives

1. To update VTA requirements on new diesel vehicles to be FAME prepared.
2. To introduce a requirement for rebuild trucks to be FAME prepared.

Action items

4.2 A: Update VTA requirements on new diesel vehicles to be FAME prepared.

a. Update related policies of VTA to include FAME prepared diesel vehicles (which enable diesel vehicles to run with higher biodiesel blends without need to upgrade any component) (2020).

b. Enforce policy of FAME prepared diesel vehicles by VTA (2023).

4.2 B: Introduce a requirement for rebuild trucks to be FAME prepared.

a. Conduct study on how to introduce the requirement as a policy (2020)

b. Implement the policy on FAME prepared requirement (2023)

Action Plan 5.1

Providing support to alternative fuel production and distribution growth for transport sector

Biogas is identified as an alternative fuel that can provide significant emission reduction. For biogas to be used in transport, the production and distribution industry of biogas need to grow first. For CNG and LNG, the market price can be attractive for industry compared to diesel. However, a stumbling block would be vehicle price. An in-depth study is needed to determine the cost/benefit for each option. Then choose preferred option to be adopted (or both).

Objectives

1. To explore possibility of capturing biogas in palm oil mills/landfills/wastewater treatment plants for transport use.
2. To incentivise purchase of NGV.
3. To explore viability for LPG of LPG Hybrid Taxi Project.

Action items

5.1 A: Explore possibility of capturing biogas in palm oil mills/landfills/wastewater treatment plants for transport use.

a. Conduct in-depth study of possibility of capturing biogas in strategic palm oil mills/landfills/ wastewater treatment plants for transportation use.
b. Identify palm oil mills/landfills/wastewater treatment plants strategic to biogas supply for transport.
c. Provide incentives under Green Technology Financing Scheme (GTFS) until 2030.

5.1 B: Incentivise purchase of NGV.

Provide tax incentives under Green Investment Technology Assets (GITA) scheme for operators who purchase NGV for biogas application purposes (2021-2025).

5.1 C: Explore viability for LPG of LPG Hybrid Taxi Project.

a. Conduct observation of development for LPG Hybrid taxi in Japan post-Olympics (2020-2021).
b. LPG Hybrid project (provided that viability study indicates positive results)

Action Plan 5.2

Developing FCEV roadmap

Sarawak is unique for having significant excess of clean energy from hydroelectric power generation. Hydrogen fuel is one possible alternative for energy export (internationally or to Peninsular Malaysia) as transmission of electrical power via electrical grid is limited. If the pilot project in Kuching and Phase 2 (exporting to Japan) are successful, the spillover effect can be very beneficial for both Sarawak and Malaysia as a whole. Hence, a one-off subsidy for vehicle purchase/retrofit should be adopted.

Objectives

1. To engage with pilot project in Kuching for further exploration of hydrogen economy.
2. To develop FCEV roadmap.

Action items

5.2 A: Engage with pilot project in Kuching for further exploration of hydrogen economy.
- a. Engage with pilot project in Sarawak.

5.2 B: Develop FCEV roadmap.
- a. Explore FCEV potential.
- b. Establish FCEV roadmap.
- c. Implement FCEV roadmap.
- d. Conduct a Hydrogen Economy study (hydrogen production, distribution and storage).

Action Plan 5.3

Reducing national electricity emission factor and enhancing renewable electricity sources

Increase in the renewable energy portion in the energy mix will reduce electricity grid emission; hence, further improving the reduction of electric mobility.

Objectives

1. To reduce national electricity emission factor.
2. To enhance renewable electricity sources.

Action items

Further enhance renewable energy portion of energy mix.

FOCUS AREA

D

GREENHOUSE GAS EMISSION & ENERGY REDUCTION VIA

MODE SHIFT

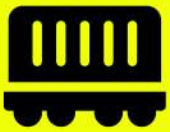
5 strategies and 17 action plans have been identified

5 STRATEGIES

Shifting Private Transport to Public Transport

Promoting Public Transport through Land-Use Development

Improving Traffic Flow



Shifting Freight Mode from Road to Rail

Promoting Active and Micro Mobility

ACTION PLANS

Shifting Private Transport to Public Transport

- Determining modal share through a national household survey
- Increase the number of stage buses and feeder buses operating in GKL and main cities
- Improving public transport (road and rail) provisions, characteristics and infrastructure
- Implementing traffic restraint measures
- Encourage implementation of BRT and/or Tram development in major cities

Promoting Public Transport through Land-Use Development

- Introducing and enhancing park-and-ride facilities at transit stations near city boundaries
- Intensifying sustainable land-use towards car-lite planning by local authorities
- Implementation of LCCF component on transport by local authorities
- Implementing transit-oriented development (TOD) and redevelopment near transit stations

Improving Traffic Flow

- Managing traffic through urban transport planning
- Implementing appropriate intelligent transport system (ITS) in cities

Shifting Freight Mode from Road to Rail

- Expanding rail network to cater for freight transport
- Providing First-Last-Mile (FLM) access to rail freight stations from/to source of freight and terminals

Promoting Active and Micro Mobility

- Improving First-Last-Mile (FLM) connectivity, access modes and infrastructure
- Encourage prolific use of electronic payments for bicycle or PMD sharing/rental
- Reviewing Existing Regulations on Personal Mobility Device (PMD) and Bicycle Usage on Public Roads
- Incorporating comprehensive walking and cycling infrastructure as FLM access modes by local authorities

Strategy 6:
Shifting Private Transport to Public Transport

This strategy is part of the focus area of GHG emission and energy reduction via mode shift.

This strategy deals with GHG emission and energy reduction by having commuters and travellers migrate from private to public transport. Public transport such as rail and buses has been found to produce substantially lower values of GHG emissions ranging from 10 to 67 gCO2eq/passenger-km, depending on load, versus 140.82 gCO2eq/passenger-km for petrol ICEV cars. As such, action plans that facilitate and encourage this mode shift will be worthy of consideration.

The study also found that the number of buses in operation is not sufficient. The number of buses/100,000 population for GKL is 19. In comparison, the World Bank Urban baseline is 50. Furthermore, the mode share in public transport needs to increase from the current 20% to the target set by various agencies which is 40% in 2030. This is to ensure a more sustainable and low carbon transport system is achieved since carbon emission per person-km of travel is much lower for public transport against private cars.

Based on the number of passenger cars registered between 2014 and 2018, 90.1% of cars are petrol-based, and 31% of them were registered in Kuala Lumpur. GHG emissions from petrol cars amount to 50.8% of total emissions in the road transport sector. There is a critical need to lessen petrol-based cars and shift users to public transport especially in Kuala Lumpur and other urban areas.

Strategy 7:
Promoting Public Transport through Land-Use Development

This strategy is part of the focus area of GHG emission and energy reduction via mode shift.

It is an established fact that land-use and transportation are interrelated. The type of development will not only determine the number of trips generated but also the mode of transport that would be utilised by trip makers. Low-density development encourages the use of private cars. On the other hand, high-density compact development makes public transport a viable option.

Public transport such as rail and bus produce substantially lower values from the range of 10 to 67 gCO2eq/passenger-km depending on load. Current mode share of public transport (20%) is lower than it used to be (1990, 37%; 1970, 47%). Mode share in public transport needs to increase from the current 20% to the target set by various agencies which is 40% in 2030. This is to ensure a more sustainable and low carbon transport system is achieved since carbon emission per person-km of travel is much lower for public transport compared to private cars. Thus, action plans that relate to land-use development that promote use of public transport would be a way forward in GHG emission reduction.

Strategy 8:
Improving Traffic Flow

This strategy is part of the focus area of GHG emission and energy reduction via mode shift.

Heavy traffic congestion is making both energy consumption and CO2 emission worse. If driving speed improves from 10 km/h to 60 km/h, fuel efficiency will improve from 0.22 litres/km to 0.06 litres/km, and CO2 emissions will be reduced from 600 gCO2/km to 100 gCO2/km. As such, improvement of traffic flow will lead to GHG reduction and energy savings.

CO_2 emission from automobiles are influenced by speed of travel. If driving speed improves from 20 km/h to 60 km/h, fuel efficiency is raised. As a result, CO_2 emissions will be reduced by about 40% (ERIA, 2017). Thus, action plans that can improve traffic flow will need to be considered for implementation.

Strategy 9:
Shifting Freight Mode from Road to Rail

This strategy is part of the focus area of GHG emission and energy reduction via mode shift.

Almost 98% of cargo freight is transported by road and only 2% by rail. Similarly, container freight carried by road is about 95%. It has been established from studies and experiences abroad that rail freight is more energy efficient and has less carbon emission compared to road freight on a per tonne-km of freight travel basis. Thus, action plans which encourage mode shift from road to rail need to be explored and implemented.

Strategy 10:
Promoting Active and Micro Mobility

This strategy is part of the focus area of GHG emission and energy reduction via mode shift.

Active mobility is a term used in the transportation discipline to mean non-motorised modes of transport, i.e. walking and cycling.

The Study Team's survey found that the majority of commuters do consider walking as an important type of FLM access mode despite weather conditions in Malaysia. This was discovered during interviews on commuters' usual FLM access mode to get to rail stations. Results show a positive perception on use of non-motorised modes of FLM to reach rail stations.

Based on the LCMB Survey, walking is competitive and could be promoted as an effective first-last mile mode at shorter distances, i.e. < 500 meters. Similarly, the bicycle mode could also be a competitive first-last mile mode for access distance below 1,500 metres from public transit nodes.

Hence, action plans that promote active and micro mobility will reduce dependency on motorised transport for FLM access modes, and they could increase public transport ridership resulting in GHG emission reduction and energy savings in the long run.

Action Plan 6.1

Determining modal share through a national household survey

A more comprehensive data of travel behaviour and trip patterns can be gained from a household survey. The modal share of various modes of transport can be easily determined from the household survey. The modal share of public transport, for example, can be easily determined for the whole city, or any geographical area if need be.

Objectives

1. To provide a transport sector section in survey as a way to improve transport related data.
2. To prepare a survey to identify specific household travel behaviour as part of the transport master plan in cities.

Action items

Option 1: Provide a transport sector section in survey as a way to improve transport-related data. One of the best ways is through a national Household Survey to be conducted by the Department of Statistics Malaysia (DOSM).

a. Conduct survey on household members travel characteristics and patterns for all household trips. Through this comprehensive household survey, a more meaningful and more complete understanding of household travel patterns can be gained.
b. Conduct regular household surveys with an interval of 4 or 5 years, particularly for the transport section.
c. Pre-test questionnaire by November 2019.

Option 2: Prepare a survey to identify specific household travel behaviour as part of the transport master plan in cities. This is done in London and Singapore where it is called the National Travel Survey and Household Travel Survey.

a. Develop a National Household Survey as a means to complement gaps and for future reference for the national transport master plan.
b. Set survey development at the national level under the Ministry of Transport (MOT) and its agency, the Land Public Transport Agency (APAD).
c. Include household travel survey (by Local Authorities) as a requirement in the transport master plan at state or municipal level.

Action Plan 6.2

Increase the number of stage buses and feeder buses operating in GKL and main cities

Currently, the number of buses/100,000 population for GKL is 19 against the World Bank Urban baseline of 50; thus, the number of buses per population is very low compared to international standards. Availability of more buses will help increase bus frequency and feeder service to the public transit system, and increase its capacity per hour. This will help attract more people to use public transport instead of private cars.

Objectives

1. To increase the number of Stage Buses in GKL and main cities.
2. To increase the number of Feeder Buses in GKL and main cities.

Action items

A: Increase the number of Stage Buses in GKL and main cities.

a. Conduct assessment on the number of stage buses necessary for GKL and other main cities based on population size.

b. Acquire extra buses to better serve the needs of public transport users.

B: Increase the number of Feeder Buses in GKL and main cities.

a. Conduct assessment on the number of feeder buses necessary for GKL and other main cities based on the number of transit stations and transport terminals.

b. Determine type of feeder buses that suit area to be served. Use mini buses for lower cost and efficiency in areas with smaller road space such as compact housing areas.

c. Acquire extra buses to better serve the needs of public transport users.

Action Plan 6.3

Improving public transport (road and rail) provisions, characteristics and infrastructure

By increasing the number of PT routes, greater accessibility to PT is made available to public which encourage higher patronage. By increasing the number of PT routes, greater accessibility to PT is made available to public which encourage higher patronage. The higher frequency of service will allow for higher capacity per hour; thus, ridership increases especially during peak hours when demand is high. With higher frequency of service more private car users will be enticed to consider taking public transport, thus, reducing private cars on the road. Real-time information on rides can reduce waiting time

Objectives

1. To increase routes for public transport (road and rail) in urban areas.
2. To improve frequency of public transport (road and rail) especially during peak hours.
3. To improve public transport stations (road and rail) and stops.
4. To develop smart applications to enhance public transport patronage.

Action items

A: Increase routes for public transport (road and rail) in urban areas.
   a. Identify new public transport routes (road and rail) including extension of existing routes for stage buses, feeder buses and rail-based transit for increased public accessibility.
   b. Plan and implement public transport services on those identified routes including necessary infrastructure and feeder services.

B: Improve frequency of public transport (road and rail) especially during peak hours.
   a. Identify public transport routes which have low service frequency and plan for higher frequency especially during peak hours.

C: Improve public transport stations (road and rail) and stops.
   a. Conduct assessment of public transport stations (bus and rail) including bus stops and determine adequacy of facilities and amenities to needs of public transport users.
   b. Improve selected stations to better serve the needs of public transport users.

D: Develop smart applications to enhance public transport patronage.
   a. Establish initiatives for public transport operators (for bus and rail) to provide online information on public transport services, timetables and real-time location information through real-time mobile apps.
   b. Establish initiatives to educate the public on these apps for PBTs and public transport operators to enhance public transport patronage.
   c. Add special features for users on personal energy savings, cost savings and emission reduction by using PT (low emission bus and rail).
   d. Add options for destination travel, cost estimates, and notification on major disruptions in service.

Action Plan 6.4

Implementing traffic restraint measures

Congestion charging will deter private car users from entering congestion charging zones unless they pay the charge imposed. In the case of London's Congestion Charging, 25% CO2 reduction was achieved, apart from travel time reduction, and social cost reduction (Euro 144 million/year). Besides, parking control will make it difficult for private car users (especially commuters) to bring their cars to the city especially the CBD because of parking limitations and higher overall travel cost of private car work trips. This will drive private car users to consider shifting to public transport.

Objectives

1. To identify and implement congestion charging in CBD/city centres.
2. To implement parking control in CBD and within city limits.

Action items

A: Identify and implement congestion charging in CBD/city centres.
   a. Incorporate congestion charge in large cities such as KL, Johor Bahru and Penang.
   b. Limit duration of charge to peak hours or only during the day.
   c. Apply no charge between 20:00 – 07:00 on weekdays or on weekends and public holidays.
   d. Use electronic payment for congestion charge.

B. Implement parking control in CBD and within city limits.
   a. Restrict parking on certain periods of the day in specified areas.
   b. Reduce parking space in CBD and in specified areas within city limits.
   c. Reduce to a minimum on roadside parking in CBD and specified areas within city limits.
   d. Increase parking charges in city limits, with highest charges in CBD.
   e. Provide only short-term parking for roadside parking within city limits.

Action Plan 6.5

Encourage implementation of BRT and/or Tram development in major cities

The BRT system will greatly build the confidence of private car users to shift towards public transport because of the inherent attractive characteristics of a reliable BRT system. The dedicated routes of the BRT is just like the dedicated rail track; thus, ensuring reliable ride times for commuters. The Trans Milenio BRT in Bogota, Columbia reduced 500,000 tons of CO2 emissions in 3 years; With Bogota's rationalised bus system, commuting time reduced by 32%. This will help attract more people to use public transport instead of private cars.

Objectives

1. To identify and implement congestion charging in CBD/ city centres.
2. To implement parking control in CBD and within city limits.

Action items

a. Embark on a detailed study on the feasibility of developing BRT systems in GKL and other main cities especially safety requirement sharing with other modes.

b. Determine network coverage of the BRT systems in GKL and main cities.

c. Determine necessary requirements for infrastructure and enablers for successful implementation of BRT systems.

Action Plan 7.1

Introducing and enhancing park-and-ride facilities at transit stations near city boundaries

Park-and-ride (P&R) facilities at transit stations will help encourage private car users to use public transit, especially when other traffic restraint measures are also in place in the city area. Hence, lower traffic volume on roads result in higher energy savings and reduction of GHG emissions. The most carbon intensive mode is the private car, ranging from 82 to 148 gCO2eq/passenger-km. Strong marketing ensures people to have access to up-to-date information. It is essential to promote services to increase uptake.

Objectives

1. To identify and enhance existing park-and-ride facilities near city boundaries.
2. To embark on a study to identify and develop new park-and-ride facilities near city boundaries.
3. To improve existing and new P&R to a smart parking system.
4. To improve security, lighting, and access to feeder bus service and pedestrian walkways.

Action items

a. Identify and enhance existing park-and-ride facilities near city boundaries to create higher demand for commuting car users to use public transit.

b. Embark on a study to identify and develop new park-and-ride facilities near city boundaries to encourage car users to use public transit especially for new rail line (MRT2 and LRT3).

c. Improve existing and new P&R to a smart parking system with features such as real-time rail or bus departures, number of parking space availability, and estimated travel time to destinations. The system can reduce parking search time. This directly reduces gas emission of cars. The system can be integrated with a smartphone application for bookings and parking.

d. Improve security, lighting, and access to feeder bus service and pedestrian walkways.

Action Plan 7.2

Intensifying sustainable land-use towards car-lite planning by local authorities

Sustainable intensification of land-use will be easier served by public transport versus urban sprawl (which will be more car dependent) Hence, there will be lower traffic volume on the roads resulting in higher energy savings and reduction of GHG emissions. According to a report, compact cities and mixed land-use has the potential reduce energy consumption by 10-30% (Wuppertal Institut and UN Habitat).

Objectives

1. To encourage Local Authorities to consider sustainable intensification of land-use development or redevelopment.
2. To incorporate planning considerations with Local Authorities

Action items

a. Encourage Local Authorities to consider sustainable intensification of land-use development or redevelopment to limit urban sprawl and move towards car-lite planning.

b. Incorporate planning considerations when Local Authorities develop or review their Local Plans or State Structure Plans.

Action Plan 7.3

Implementation of LCCF component on transport by local authorities

The transport component of LCCF gives examples on actions that can be taken to achieve low carbon cities and provides methods to determine the effectiveness of actions taken. Hence, there will be lower traffic volume on the roads resulting in higher energy savings and reduction of GHG emissions.

Objectives

1. To encourage Local Authorities to consider implementing the low carbon city framework (LCCF)
2. To incorporate LCCF into planning considerations.
3. To review LCCF transport elements.

Action items

a. Encourage Local Authorities to consider implementing the low carbon city framework (LCCF) component on transport developed by MGTC.

b. Incorporate LCCF into planning considerations when Local Authorities develop or review their local plans.

c. Review LCCF transport elements to assist PBTs implementation.

Action Plan 7.4

Implementing transit-oriented development (TOD) and redevelopment near transit stations

The nature of TOD will ensure that most trips made to/from TOD will be made using transit, either rail-based or road-based. As such, less private cars will be needed to make the trips. Thus, less cars will be found on the road because of higher usage of public transport. This results in higher energy savings and reduction of GHG emissions. According to a 2002 study by the California Department of Transportation, TOD has the potential to reduce annual greenhouse gas emissions by 2.5 to 3.7 tons per year for each household.

Objectives

1. To develop and implement TOD guidelines (by PLANMalaysia).
2. To embark on a specific detailed study to explore the possibility of implementing transit-oriented development.
3. To identify transit stations involved and land parcels to be developed.

Action items

a. Develop and implement TOD guidelines (by PLANMalaysia) suitable for the Malaysian transport environment.

b. Embark on a specific detailed study to explore the possibility of implementing transit-oriented development and/or redevelopment near transit stations.

c. Identify transit stations involved and land parcels to be developed or redeveloped into TOD (from detailed study).

Action Plan 8.1

Managing traffic through urban transport planning

Transportation planning has to be conducted together with land-use planning since land-use type will have implications on trip generation characteristics, both production and attraction patterns. A low-density urban sprawl will be difficult for public transport to operate and mobility will be highly car dependent. On the other hand, a high-density compact residential development, for example, is conducive for operation of public transport (including public transit). As such, urban transport planning must not be treated as a city planning element that is planned on its own in the local planning process.

Objectives

1. To encourage Local Authorities to consider urban transport planning as a fundamental component of city planning especially for traffic management.

Action items

Encourage Local Authorities to consider urban transport planning as a fundamental component of city planning especially for traffic management when revising Local Plans.

In current practice, transport is considered as one of the sectors that is planned on its own. Whereas in transport planning (or transport land-use planning), it is in reality directly linked to land-use. It cannot be done in silo.

Either land-use led or transport led, planning has to be done together. As such, urban transport planning has to be done in the proper context as far as local plans are concerned.

Action Plan 8.2

Implementing appropriate intelligent transport system (ITS) in cities

An appropriate ITS which can optimise traffic signals operations and improve traffic flow will result in increased traffic speed, thus, reducing fuel consumption and vehicle emissions since traffic speed is directly related to fuel consumption and emissions. Congestion levels in road networks can be reduced by improving traffic flow through junctions and intersections. Thus, improvement of traffic flow especially during the peak hours will result in energy savings and emission reductions.

Objectives

1. To optimise traffic signal operations for optimised traffic flow.
2. To establish concerted efforts to ensure ITS usefulness in performing tasks.

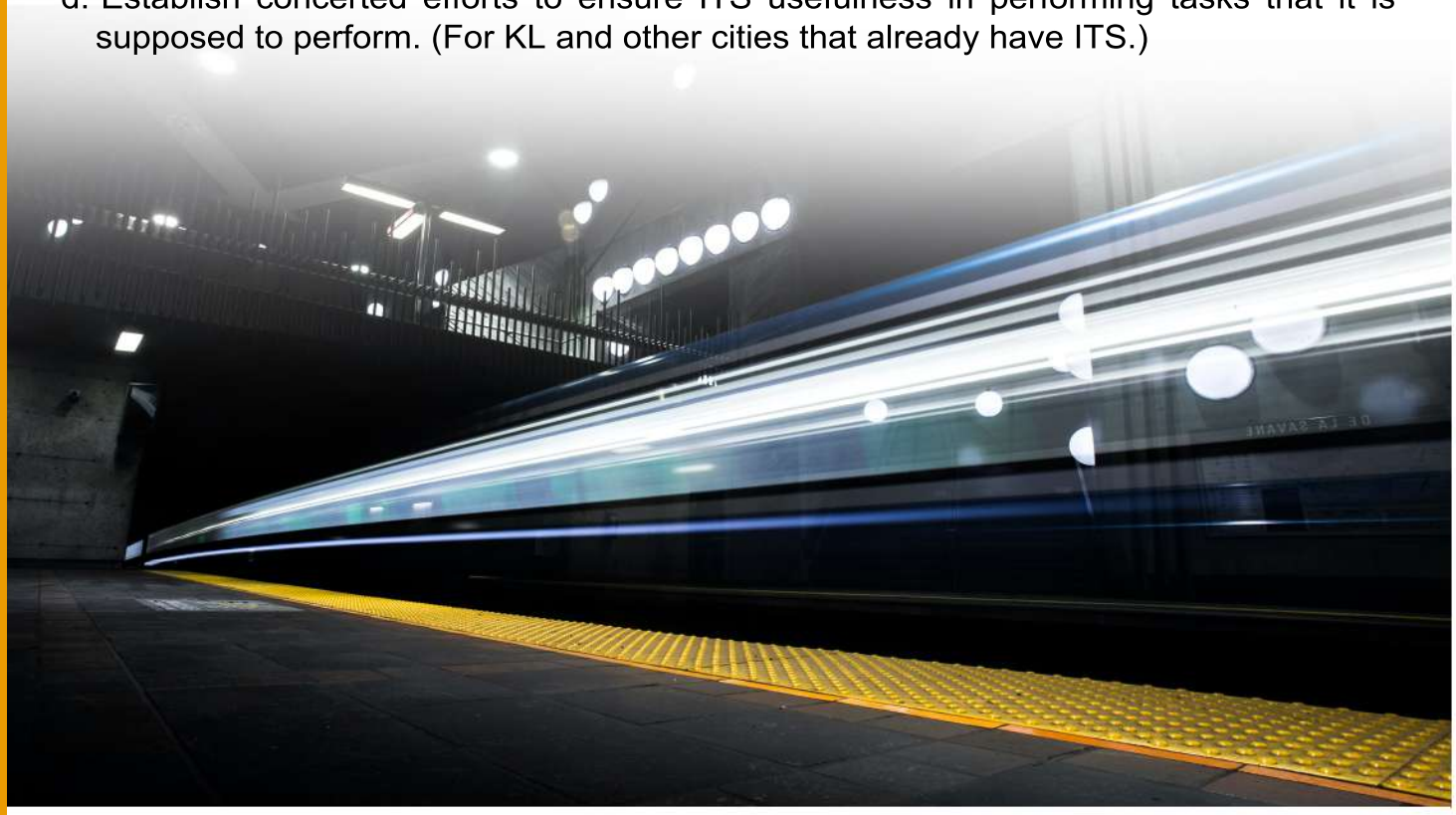
Action items

a. Employ an appropriate intelligent transport system (ITS) to optimise traffic signal operations for optimised traffic flow, and, to a certain extent, in the road network.

b. Conduct a feasibility study on traffic conditions and locations/zones before implementing ITS.

c. Require PBTs to decide on an appropriate ITS to be used for the its city or township.

d. Establish concerted efforts to ensure ITS usefulness in performing tasks that it is supposed to perform. (For KL and other cities that already have ITS.)



Action Plan 9.1

Expanding rail network to cater for freight transport

Cargo freight is transported 98% by road and only 2% by rail. Similarly, about 95% of container freight are carried by road. On average, rail freight only uses about 15% as much energy as heavy duty trucks per tonne-km. As such, some shift of freight from road to rail will result in significant energy savings and GHG reductions.

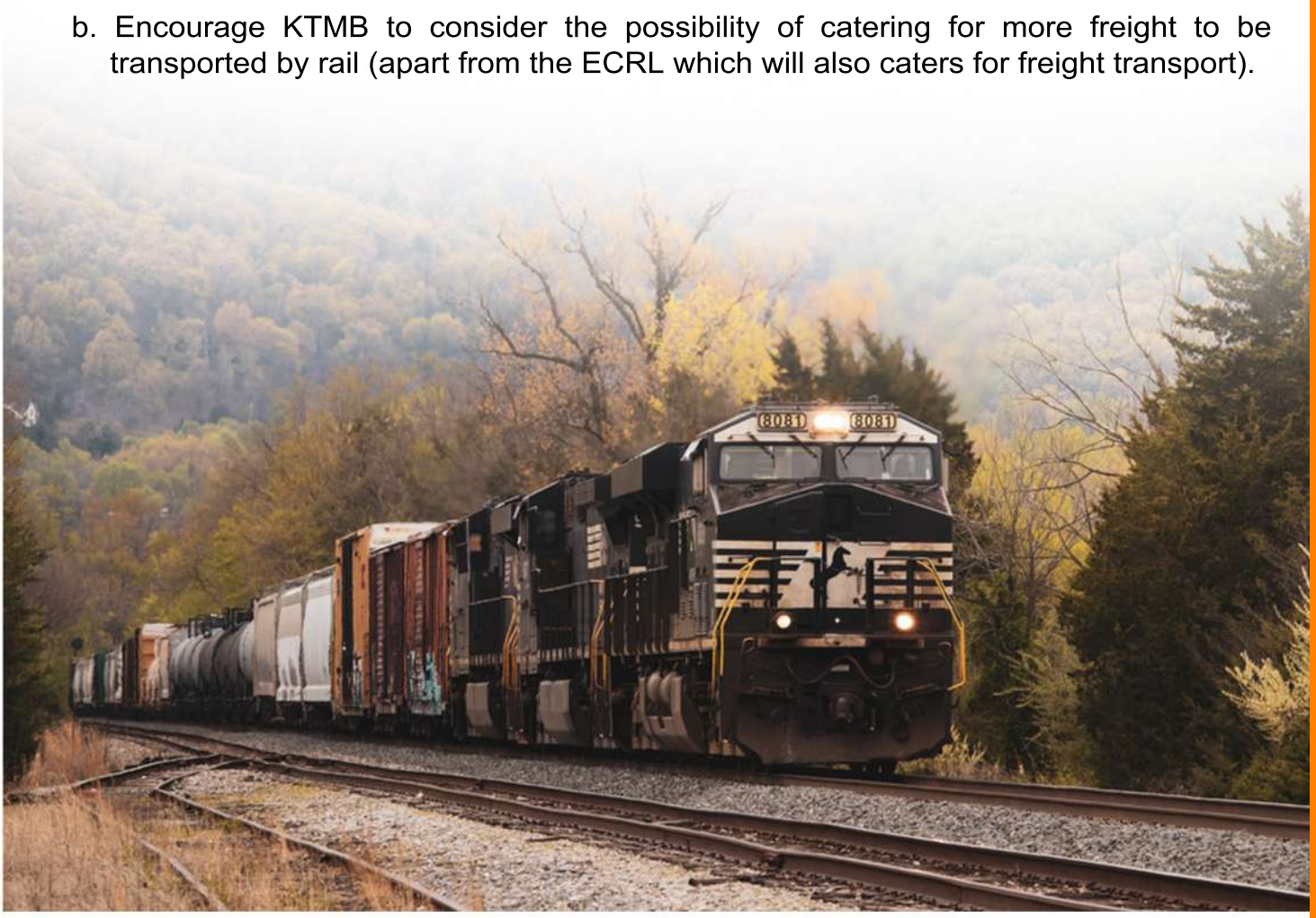
Objectives

1. To embark on a specific detailed study to explore possibility of expanding existing rail network.
2. To encourage KTMB to consider the possibility of catering for more freight to be transported by rail.

Action items

a. Embark on a specific detailed study to explore possibility of expanding existing rail network to cater for freight transportation.

b. Encourage KTMB to consider the possibility of catering for more freight to be transported by rail (apart from the ECRL which will also caters for freight transport).



Action Plan 9.2

Providing First-Last-Mile (FLM) access to rail freight stations from/to source of freight and terminals

Cargo freight is transported 98% by road and only 2% by rail. Similarly, about 95% of container freight are carried by road. On average, rail freight only uses about 15% as much energy as heavy duty trucks per tonne-km. As such, some shift of freight from road to rail will result in significant energy savings and GHG reductions. The FLM access to rail freight stations will further encourage long haul freight to be transported by rail.

Objectives

1. To embark on a specific detailed study to explore possibility of providing first-last-mile (FLM) access to rail freight stations.
2. To propose better route optimisation technologies.

Action items

a. Embark on a specific detailed study to explore the possibility of providing first-last-mile (FLM) access to rail freight stations from/to source of freight and terminals. The FLM access could either be rail-based or road-based.

b. Propose better route optimisation technologies which to help reduce woes over last mile capacity.

Action Plan 10.1

Improving First-Last-Mile (FLM) connectivity, access modes and infrastructure

An improved FLM connectivity, access modes and infrastructure will encourage higher ridership on public transport, hence, there will be fewer private cars on the roads, more energy savings and less GHG emissions.

Objectives

1. To encourage Local Authorities (which have public transit stations and public transport terminals) to consider upgrading FLM connectivity.
2. To upgrade FLM connectivity with interconnected barrier-free pedestrian walkways and cycle lane network throughout the urban areas.
3. To upgrade FLM access modes, infrastructures and in planning process.

Action items

a. Encourage Local Authorities (which have public transit stations and public transport terminals) to consider upgrading FLM connectivity, access modes and related infrastructure.

b. Upgrade FLM connectivity with interconnected barrier-free pedestrian walkways and cycle lane network throughout the urban areas from and to transit points (full coverage and availability).

c. Upgrade FLM access modes with NMT modes, feeder buses, apps based on-demand modes.

d. Upgrade FLM infrastructure with walkways, crossings, cycle lanes, cycle parking, traffic controls, signages, etc.

e. Incorporate upgrades in planning process when Local Authorities develop or review local plans.

Action Plan 10.2

Encourage prolific use of electronic payments for bicycle or PMD sharing/rental

The use of electronic payments for bicycle rental will encourage the use of bicycle as attractive FLM mode. With bicycle or PMD as FLM access mode will encourage higher ridership on public transport, hence fewer private cars on the roads, more energy savings and less GHG emissions. Reducing vehicle trips by using lower/non emission mobility device. Besides for FLM connectivity to and from rail/bus station, it also can be for various short trips such as shopping trips, working trips, school trips and others.

Objectives

1. To encourage Local Authorities encourage the use of bicycles in the city/township.
2. To incorporate appropriate and easy electronic payment method and attractive system of pick-up and drop-off.
3. To incorporate into Local Authorities planning process.

Action items

a. Local Authorities need to encourage the use of bicycles in the city/township and allow private bicycle operators to provide bike rental schemes with proper guidelines for their operations.

b. The bike operators have to incorporate appropriate and easy electronic payment method and attractive system of pick-up and drop-off (example like in central London) to make it more attractive for users of public transport to use bicycle as FLM mode.

c. This can be incorporated into the planning process when Local Authorities are developing or reviewing their local plans.

Action Plan 10.3

Reviewing Existing Regulations on Personal Mobility Device (PMD) and Bicycle Usage on Public Roads

The use of bicycles and PMDs as FLM modes will increase ridership in public transport. There is a marked increase of PMD users in the younger generation. With higher ridership on public transport and, hence, lesser private cars on roads, there will be more energy savings and less GHG emissions.

Objectives

1. To consider relooking into the Road Transport Act and other related regulations to allow for bicycles and PMDs to be used on roads
2. To allow commuters to use bicycles and PMDs as FLM modes to get to/from public transit stations.

Action items

a. At present, bicycles cannot be legally used on regular roads and are only allowed on pedestrian walkways.

b. MOT needs to consider relooking into the Road Transport Act and other related regulations to allow for bicycles and PMDs to be used on roads even though there are no designated cycle lanes currently. Cyclists must have proper gear including safety helmets and bicycles should be road worthy.

c. Until there are designated cycle lanes, this measure needs to be considered to allow commuters to use bicycles and PMDs as FLM modes to get to/from public transit stations.

Action Plan 10.4

Incorporating comprehensive walking and cycling infrastructure as FLM access modes by local authorities

Walking and cycling as FLM modes will increase ridership in public transport. Vehicle trips can be reduced by using lower/non-emission mobility device. Besides rail/bus FLM connectivity, it can also be used for various short trips such as shopping trips, working trips, school trips and others. A strong marketing and awareness campaign can help ensure a shift towards a healthy lifestyle. It is essential to promote these services to increase uptake.

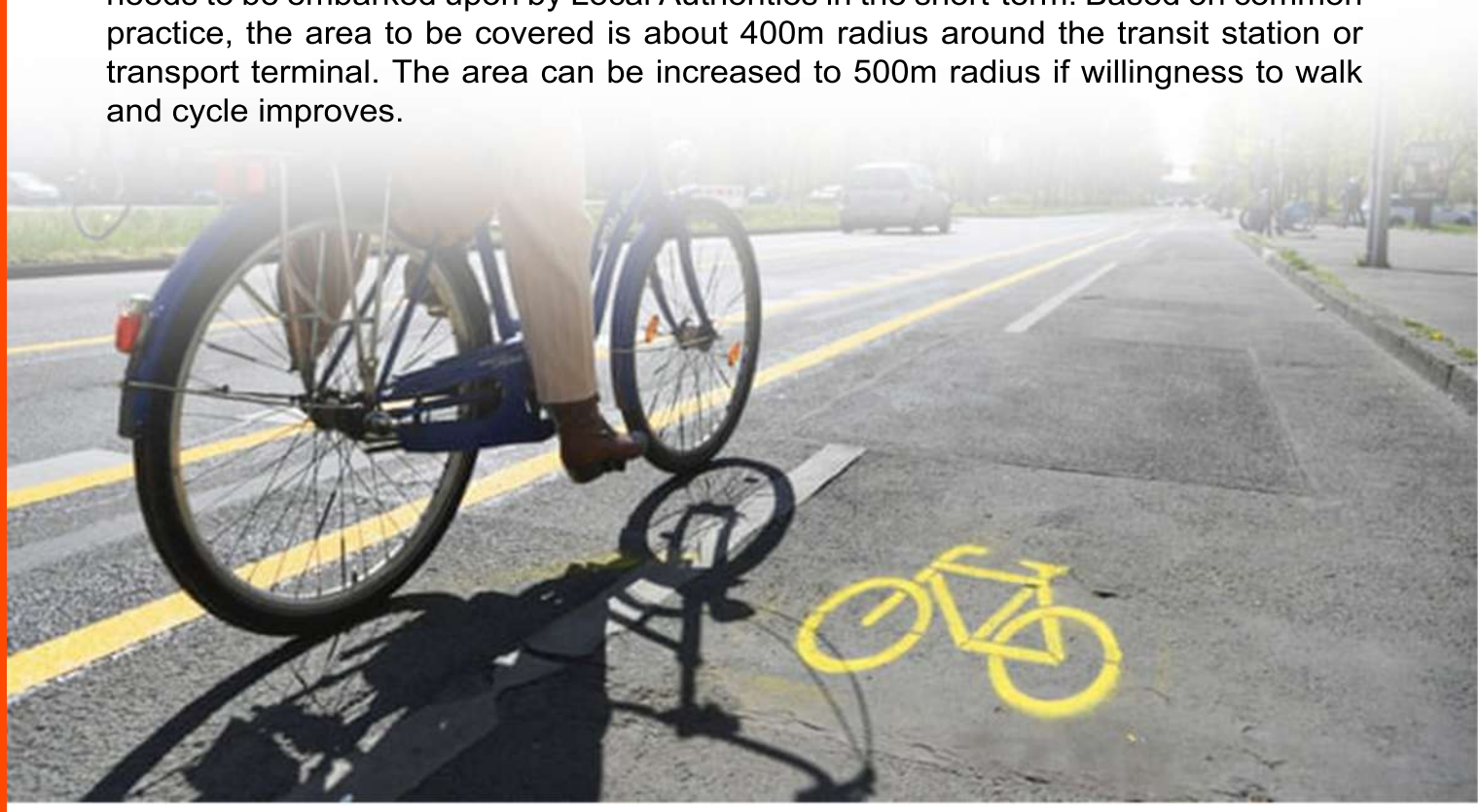
Objectives

1. To incorporate a comprehensive walking and cycling network and infrastructure as FLM access modes.
2. To design, evaluate and implement NMT modes in network and infrastructure.

Action items

a. Incorporate a comprehensive walking and cycling network and infrastructure as FLM access modes to/from transit stations and transport terminals when developing or revising Local Plans (by Local Authority).

b. Design, evaluate and implement NMT modes in network and infrastructure. This needs to be embarked upon by Local Authorities in the short-term. Based on common practice, the area to be covered is about 400m radius around the transit station or transport terminal. The area can be increased to 500m radius if willingness to walk and cycle improves.



IMPACT ASSESMENT

The impact of the LCMB strategies and action plans on energy consumption, GHG emission and expenditure on fuels are determined by using the Long-Range Energy Alternatives Planning System (LEAP) software, developed by the Stockholm Environment Institute (SEI). The impact is equal to the differences in energy and GHG emissions between the Business As Usual Scenario, on the one hand, and Scenario 1 and LCMB Scenario on the other.

The action plans for the three scenarios are differentiated by policy targets provided in Table 7.1. All scenarios share common assumptions on future GDP and population growth.

Table 7.1: Policy Targets for All Scenarios

Business as Usual (BAU) Scenario
This scenario is modelled based on historical data and trends regarding population and GDP growth assuming there will be no new energy and GHG emission policy initiative.
Implemented Policy Targets: a. 7% biodiesel content (B7) - 2015-2018 b. 10% biodiesel content (B10) - 2019-2020 c. 2% (by 2019) and 20% (by 2025) RE mix in electricity generation
Scenario 1
This scenario subsumes the BAU scenario and further incorporates effects of new policy initiatives that have already been announced by the Government of Malaysia but has yet to be implemented.
Announced Policy Targets: a. 20% biodiesel content (B20) in 2021 b. Assumed 1% passenger shift from road to rail by 2030 from the following announced targets: i. Operation of MRT 2 beginning 2021 ii. Operation of LRT 3 beginning 2024 iii. Operation of ECRL (passenger and freight mode shift) beginning 2027 c. Assumed 1% road freight to rail by 2030 from the following announced targets: i. Operation of ECRL beginning 2027 d. 100% of total industry volume (cars) being EEV beginning 2020 - NAP 2014
LCMB Scenario
This scenario incorporates additional policies proposed by this study and those already considered in Scenario 1. The strategies/policies have the following targets:
Proposed Policy Targets (by 2030): a. Increase share of energy-efficient car travels: ICE 10%, Diesel 6%, ICE-EEV 73.9%, HEV 5%, EV 5%, NGV 0.10% b. Reduce car travels by 10% to bus, 5% to rail, and 1% to motorcycle c. Shift use of conventional motorbikes to e-bike (85%:15%) d. Adopt cleaner energy for bus: E-bus 20%, and B100 for 30% of big bus e. Adopt cleaner energy for taxi: diesel 0%, petrol 0%, NGV 0%, EV (20%) and ICE-EEV 80% f. Shift from CNG and LNG to biogas (2%) g. Promote eco-driving: 10% reduction in energy use for freight vehicles and buses and 1% for other road vehicles h. Improve traffic management: 2% reduction in energy use for all classes of road vehicles i. Shift of 5% from road-based freight to rail

Impact on Future Energy Consumption

Final energy consumption in BAU scenario is projected to increase from 18,707.5 ktoe in 2015 to 31,645.3 ktoe in 2030. Compared to BAU, energy consumption is expected to be lower under Scenario 1 by 236.3 ktoe in 2020, and by 3,035.5 ktoe in 2030 (Figure 7.1). The corresponding reduction in the LCMB Scenario is larger, i.e. 401.2 ktoe in 2020 and 8,770.5 ktoe in 2030.

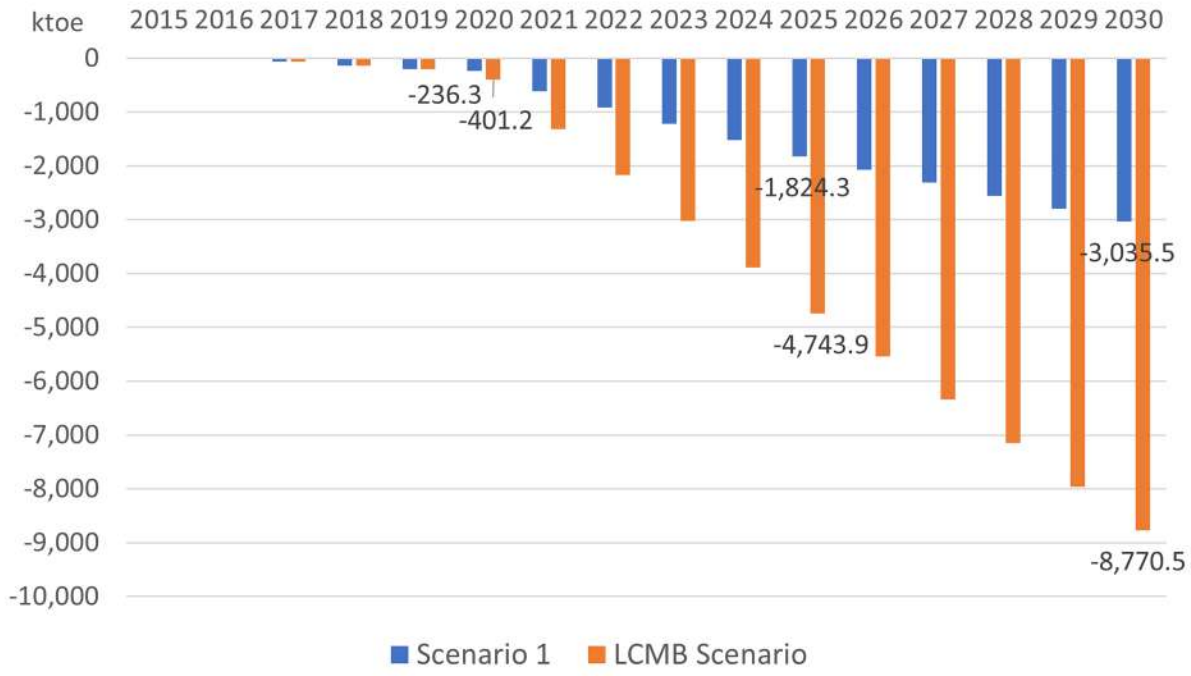


Figure 7.1: Reduction in Final Energy Consumption for Scenario 1 and LCMB Scenario (Source: LEAP Model Output)

Note: Results are based on the best-case scenario where all targets under the given scenario are achieved. Actual results will be subject to the availability of funding, technology, etc. This disclaimer is valid for all subsequent plots and figures.

Impact on Future GHG Emission

Consistent with the upward trend in final energy consumption in BAU scenario, total GHG emission is projected to increase from 56.0 million tonnes in 2015 to 94.5 million tonnes in 2030 (Figure 7.2). This increase corresponds to an average annual growth rate of 3.5% per year.

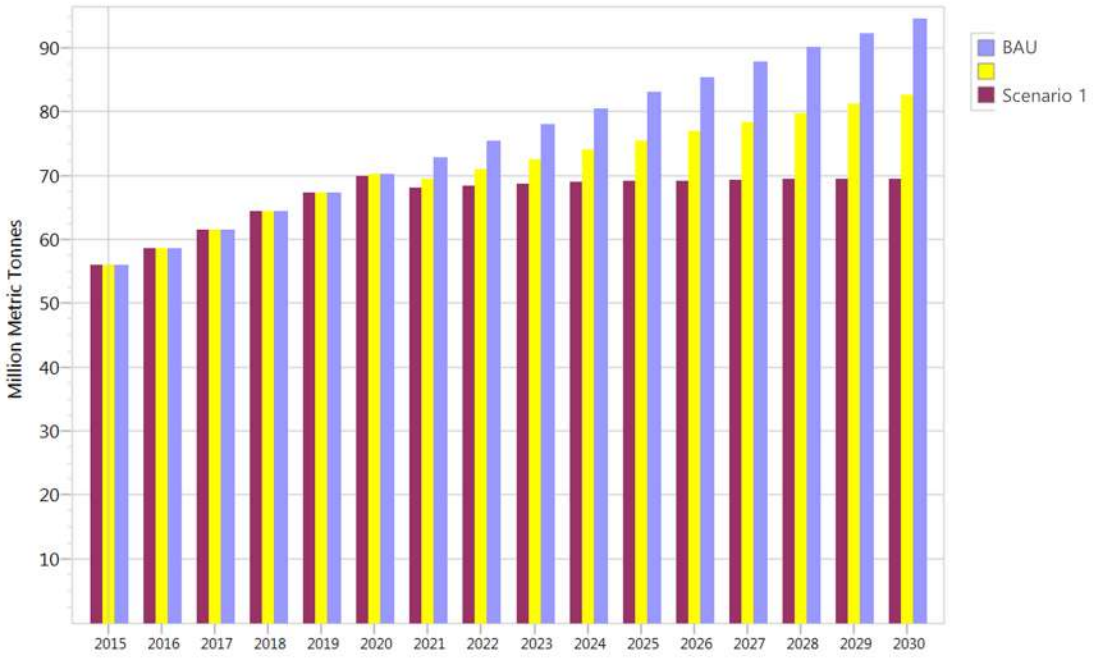


Figure 7.2: Total GHG emission by Scenario 2015-2030
(Source: LEAP Model Output)

Some reduction in GHG emission is expected under Scenario 1 as the implementation of several announced policy initiatives takes effect. The magnitude of reduction is relatively small, however. GHG emission is forecast to be lower under Scenario 1 by 0.69 million tonnes in 2020, and by 11.87 million tonnes in 2030 (Figure 7.3). The reductions are expected to be significantly larger under the LCMB Scenario compared to BAU, i.e. 1.18 million tonnes in 2020 and 26.90 million tonnes in 2030.

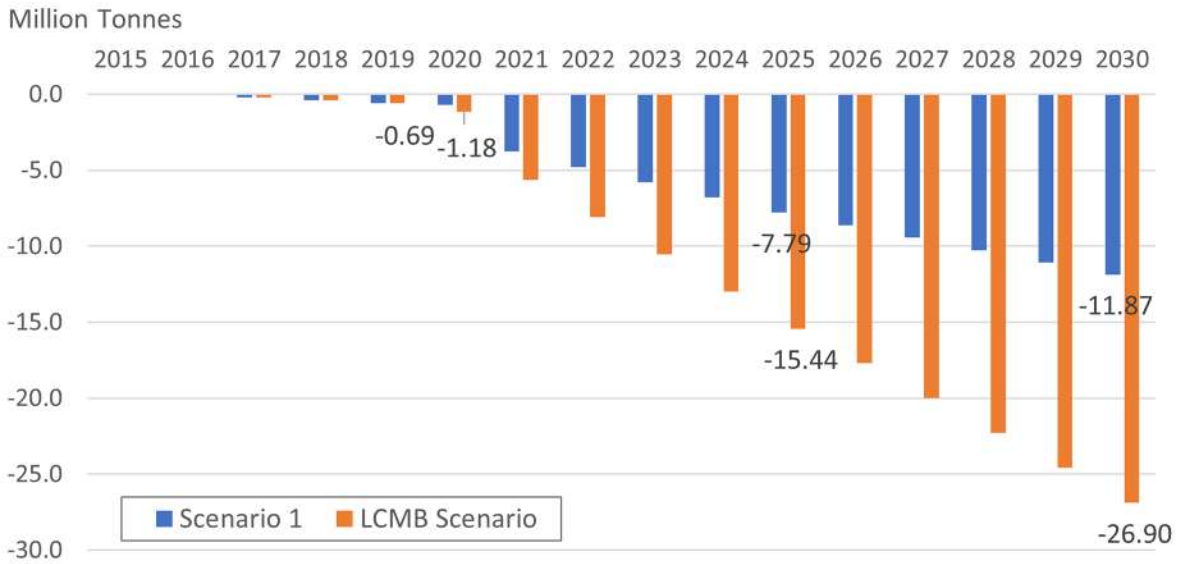


Figure 7.3: Reduction in GHG Emission for Scenario 1 and LCMB Scenario
(Source: LEAP Model Output)

Note: Results are based on the best-case scenario where all targets under the given scenario are achieved. Actual results will be subject to the availability of funding, technology, etc. This disclaimer is valid for all subsequent plots and figures.

Potential Reduction in GHG Emission and Energy Use by Strategy

Table 7.2 provides the estimated reduction in energy use and GHG emission by strategy for 2030. The impact on energy use varies by strategy with a range of 1.35 to 2,928.3 ktoe. Strategy 1, by encouraging the adoption of low emission vehicles, exerts the biggest impact by reducing the expected energy use by 2,928.3 ktoe, followed by Strategy 2 at 1,200.9 ktoe.

In terms of impact on GHG emission, Strategy 1 is expected to produce the largest reduction of 9.25 million tonnes in 2030. This is followed by Strategy 4. This strategy is forecast to yield the second largest reduction amounting to 4.35 million tonnes of GHG emission.

Strategy 5 focuses on long term (beyond 2030) benefits in GHG emission reduction; hence, despite the low reduction in GHG emission in 2030, it is considered to be important for long term impact beyond 2030 for the country.

Table 7.2: Reduction in GHG Emission and Energy Use by Strategy (2030)

Strategy	Energy Use Reduction (ktoe)	Emission Reduction (Million Tonnes)
Strategy 1 Encouraging Adoption of Low Emission Vehicles	2,928.29	9.25
Strategy 2 Strengthen Eco Driving Program	1,200.93	3.30
Strategy 3 Adopting Electric Mobility in Strategic Applications	2000.58	2.83
Strategy 4 Enhancing Use of Biodiesel in Road Transport	128.37	4.35
Strategy 5 Creating an Eco-system for Growth of Alternative Fuel and Energy Industry	1.35	0.06
Strategy 6 Shifting Private Transport to Public Transport	846.16	2.41
Strategy 7 Promoting Public Transport through Land-Use Development	391.88	1.10
Strategy 8 Improving Traffic Flow	678.36	1.98
Strategy 9 Shifting Freight Mode from Road to Rail	513.50	1.40
Strategy 10 Promoting Active and Micro Mobility	81.08	0.22
Total	8,770.5	26.9

(Source: LEAP Model Output)

Impact on Total Primary Energy Supply (TPES)

Changes in energy consumption due to the implementation of proposed strategies and action plans will change the TPES for the whole economy as energy supply responds to variations in demand. To this extent, it only represents the impact of proposed policies in the transport sector. The supply responses will be manifested, for example, by changes in imports, exports and primary production. As a result of announced policies (Scenario

1) and the implementation of low carbon strategies and action plans (LCMB Scenario), net overall reduction in energy demand is expected. Supply responses in total energy units in Scenario 1 and LCMB Scenario (after taking into account the transformation factor for secondary supply where applicable) are shown in Figure 7.5. For example, compared to BAU, TPES in LCMB Scenario is expected to be lower by 4,102 ktoe and 7,538 ktoe in 2025 and 2030 respectively. The corresponding values for Scenario 1 are 1,798 ktoe and 2,982 ktoe.

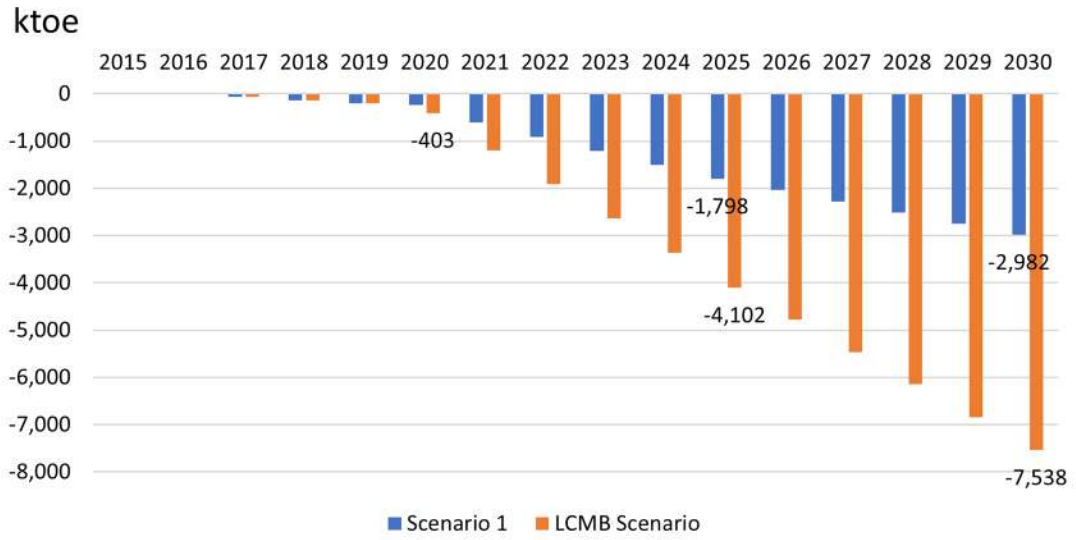


Figure 7.5: Reduction in TPES in Scenario 1 and LCMB Scenario
(TSSM Study Team's Estimate)

Note: Results are based on the best-case scenario where all targets under the given scenario are achieved. Actual results will be subject to the availability of funding, technology, etc. This disclaimer is valid for all subsequent plots and figures.

Consistent with the finding that the reduction in energy expenditure in the LCMB Scenario is due to decreases in petrol and diesel consumption, Figure 7.6 shows that most of the reduction in TPES are from the crude oil and petroleum product category. Conversely, the increase in TPES are accounted for by natural gas, hydropower and solar. This is mainly due to the rise in consumption in electricity over the forecast period.

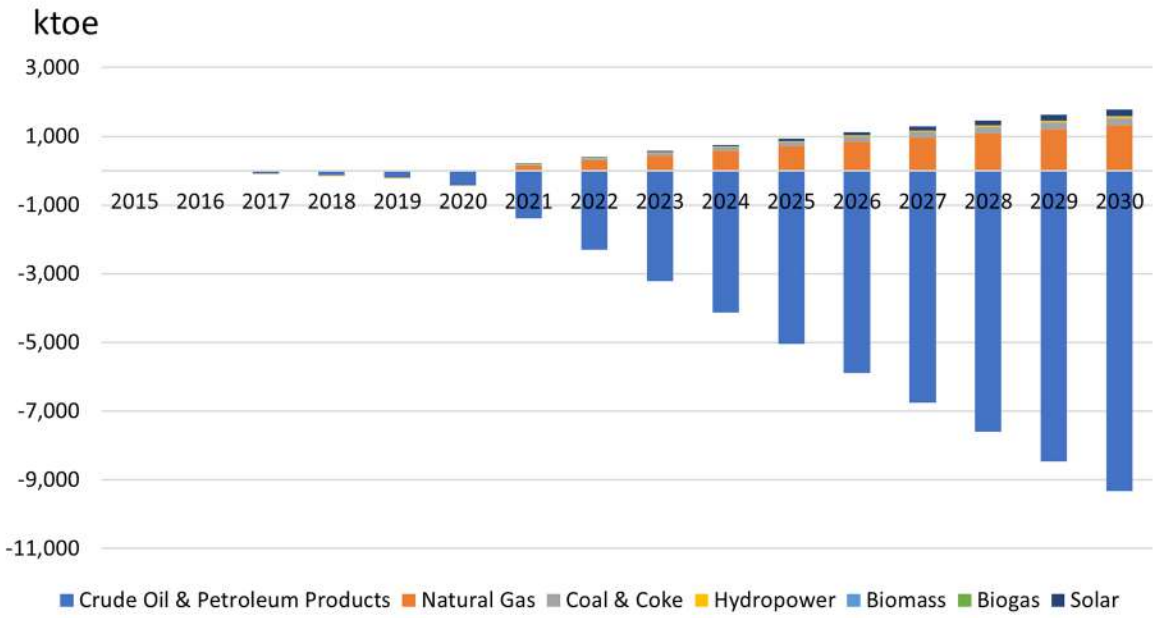


Figure 7.6: Reduction in TPES by Energy Source for LCMB Scenario
(TSSM Study Team's Estimate)

Costs and Benefits

Reduction in Energy Expenditure

Two obvious benefits of implementing policy initiatives for the LCMB scenario is the reduction in expenditure on fuels and the gain in reduced GHG emission. The reduction in expenditure of fuels was estimated based on current fuel prices (i.e. petrol - RM2.30/litre, CNG - RM1.05/litre, diesel - RM2.15/litre, and electricity RM0.3945/kWh). Figure 7.4 shows the relative total expenditure on fuels for all three scenarios for the period of 2015 to 2030. As expected, some modest savings in expenditure on fuels were generated by the implementation of policy initiatives in Scenario 1. For example, in 2030, expenditure on fuels is lower by 10.0% under Scenario 1 (RM80.9 billion) versus the BAU Scenario (RM89.9 billion). In contrast, savings in expenditure on fuels produced under the LCMB Scenario is substantially larger. By 2030, the total annual expenditure is lower for the LCMB scenario by 27.1% (RM24.3 billion) compared to the BAU Scenario. Total expenditure on fuel for the LCMB Scenario in 2030 is expected to be RM65.5 billion. The present value of the sum of savings in expenditure on fuels (from 2020 to 2030) due to the implementation of the policy initiatives for LCMB scenario amounts to RM79.5 billion .

At 8% discount rate.

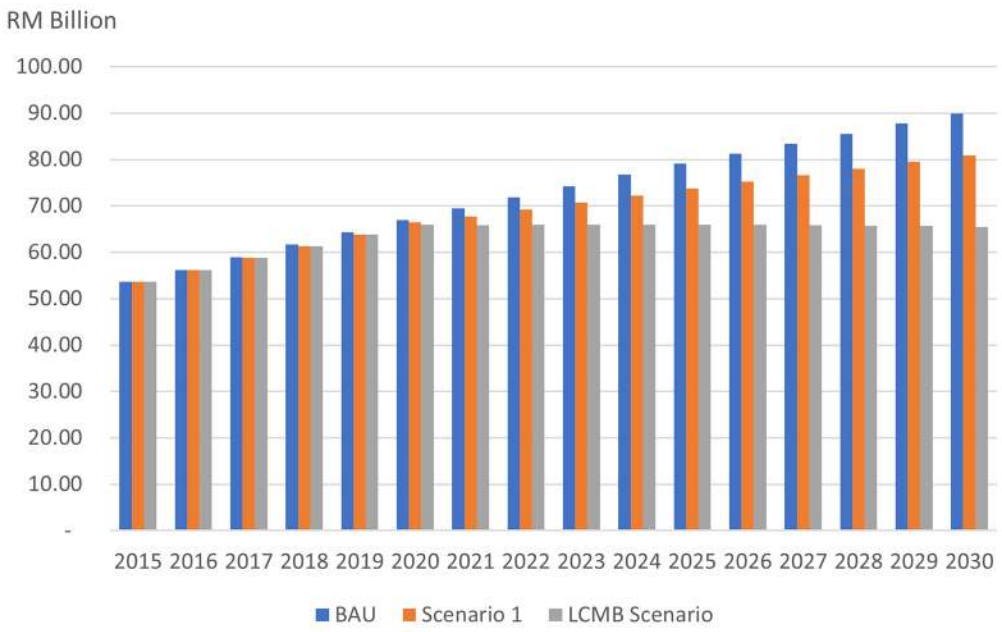


Figure 7.7: Expenditure on Energy by Scenario (2015-2030)
(Source: LEAP Model Output)

Note: Results are based on the best-case scenario where all targets under the given scenario are achieved. Actual results will be subject to the availability of funding, technology, etc. This disclaimer is valid for all subsequent plots and figures.

Economic Value of Reduced GHG Emission

Apart from producing benefit in the form of expenditure on fuel reduction, policy initiatives for the LCMB scenario will also bring about positive impact on global climate through GHG emission reduction. The GHG emission for the LCMB scenario is consistently lower than the BAU scenario for years 2020 to 2030. In 2030 alone, GHG emission under the LCMB scenario (67.6 million tonnes) is 28.5% lower than that under the BAU scenario (94.5 million tonnes).

The economic value of GHG emission reduction can be determined by multiplying the emission reduction with the market price for carbon currently trading in the emission market. In tandem with the growing magnitude of reduction in GHG emission from 2020 onwards, the economic value of benefit is expected to rise from RM0.1 billion in 2020 to RM2.4 billion in 2030. The present value of total economic benefit, at an 8% discount rate, for the 2020 to 2030 period is estimated at RM8.4 billion.

Cost and Benefit by Strategy

The effective and efficient implementation of all strategies in the LCMB Action Plan requires an average governmental commitment of RM 1.25 billion per year. The public budget will cover the cost to administer and incentivise the LCMB initiatives. The total public expenditure based on the detailed action plans listed above, including through infrastructure improvement and fiscal incentives estimated to be in the region of RM 13.74 billion million over the course of 11 years from 2020 to 2030, in turn will be expected to induce private sector investments estimated to be at RM2.3 billion. By 2030, the total annual expenditure on fuel is expected to be lower by RM24.3 billion.

Policy initiatives proposed in this study will also bring about positive impact on global climate through GHG emission reduction. The economic value of GHG emission reduction can be determined by multiplying the emission reduction with the market price for carbon currently trading in the emission market. This study notes that the computed value refers to “economic value” of reduction in GHG emission. It is not meant to represent the value of financial claims that can be obtained by selling carbon credits.

The overall cost-benefit estimated after taking into account the above costs and benefit as well as multiplier impact on the economy from additional private sector investments during the plan period is summarized in Table 7.3. Positive net benefits are strongest from Strategy 1 (Encouraging Adoption of Low Emission Vehicles), followed by Strategy 3 (Adopting Electric Mobility in Strategic Applications), if implemented at scale.

Table 7.3: Estimated Costs and Benefits by Strategy and Phase

Strategy	2020 – 2022 (RM millions)					2023 – 2025 (RM millions)					2026 – 2030 (RM millions)					Net Benefits by Strategy (RM million)			
	Public Sector Expenditure	Private Sector Expenditure	Private Individual Costs	Reduced Energy Benefits	Reduced GHG Emission Benefits	Public Sector Expenditure	Private Sector Expenditure	Private Individual Costs	Reduced Energy Benefits	Reduced GHG Emission Benefits	Public Sector Expenditure	Private Sector Expenditure	Private Individual Costs	Reduced Energy Benefits	Reduced GHG Emission Benefits	Total Benefits	Total Costs	Net Benefits	GHG Benefits
1	2.5	13.5	-	3,537	452	3.0	-	117.0	10,747	1,180	3.0	-	195.0	33,117	3,378	52,412	334.0	52,077.7	5,011
2	1.5	-	-	1,451	161	-	-	-	4,408	421	-	-	-	13,582	1,205	21,228	1.5	21,226.1	1,788
3	749.3	51.3	-	2,416	361	520.0	95.0	659.0	7,342	361	195.0	97.0	1,221.0	22,658	1,034	34,172	3,587.5	30,584.7	1,756
4	0.8	-	-	155	213	-	-	-	471	555	5.0	-	-	1,452	1,589	4,434	5.8	4,428.4	2,356
5	3.0	-	-	2	3	2.0	-	-	5	8	2.0	-	-	15	22	55	7.0	47.5	33
6	6.5	-	-	1,022	118	2.0	-	-	3,106	307	2.0	-	-	9,570	880	15,002	10.5	14,992.0	1,305
7	-	530.0	-	473	54	-	820.0	-	1,438	140	-	800.0	-	4,432	402	6,939	2,150.0	4,789.4	596
8	-	-	-	819	97	2.0	-	-	2,490	253	2.0	-	-	7,672	723	12,053	4.0	12,049.4	1,073
9	1.0	-	-	620	68	-	-	-	1,885	179	-	-	-	5,807	511	9,070	1.0	9,069.4	758
10	23.0	-	-	98	11	33.0	-	-	298	28	23.0	-	-	917	80	1,432	79.0	1,352.7	119
TOTAL	**787.6**	**594.8**	-	**10,594**	**1,537**	**562.0**	**915.0**	**776.0**	**32,189**	**3,432**	**232.0**	**897.0**	**1,416.0**	**99,221**	**9,825**	**156,797**	**6,180.3**	**150,617.2**	**14,794**

CONCLUSION

This report presents the results of the LCMB study in the form of strategies and action plans that are appropriate to achieve the objectives and goal that have been specified in terms of reduction in energy consumption and GHG emissions. A brief description of the strategies and action plans have been presented together with the expected outcomes in terms of energy savings, GHG emission reductions, and expected economic benefits associated with them. With the implementation of these strategies and action plans, it is envisaged that low carbon mobility in land transport will be achieved by 2030.

APPENDIX

LIST OF STAKEHOLDERS INVOLVEMENTS AND CONTRIBUTION

Ministry / Regulatory /Agencies

KASA	Ministry of Environment and Water
MGTC	Malaysian Green Technology Corporation
DOE	Department of Environment Malaysia
MOT	Ministry of Transport
JPJ	Road Transport Department Malaysia
APAD	Land Public Transport Agency
PUSPAKOM	PUSPAKOM Sdn Bhd
MITI	Ministry of International Trade and Industry
MARii	Malaysia Automotive, Robotics & IoT Institute
MOSTI	Ministry of Science, Technology and Innovation
MIGHT	Malaysian Industry-Government Group for High Technology
KeTSA	Ministry of Energy and Natural Resources
ST	Energy Commission
MPI	Ministry of Primary Industry
MPOB	Malaysian Palm Oil Board
MOF	Ministry of Finance
MEA	Ministry of Economic Affairs
TDA	Technology Depository Agency
SIRIM	SIRIM Berhad
KPKT	Ministry of Housing and Local Government
MOW	Ministry of Works
LLM	Lembaga Lebuhraya Malaysia
JKR	Public Works Department Malaysia
KWP	Ministry of Federal Territories
PLANMalaysia	Federal Department of Town and Country Planning

Council/Municipal/Local Authority

DBKL	Dewan Bandaraya Kuala Lumpur
MPSepang	Majlis Perbandaran Sepang
PPj	Putrajaya Corporation
MPSJ	Majlis Perbandaran Subang Jaya
IRDA	Iskandar Regional Development Authority
MPHTJ	Majlis Perbandaran Hang Tuah Jaya
MPSI	Majlis Perbandaran Seberang Perai

OEMs/ Private Operators/ Companies

PRASARANA	Prasarana Malaysia Berhad
Rapid Rail	Rapid Rail Sdn Bhd
Rapid Bus	Rapid Bus Sdn Bhd
MRT Corp	Mass Rapid Transit Corporation Sdn Bhd
TNB	Tenaga Nasional Berhad
Single Buyer	Single Buyer TNB
TNBES	TNB Energy Services
SPANCO	Spanco Sdn Bhd
DRB-HICOM	DRB-HICOM Berhad
PROTON	Proton Holdings Berhad
ECLIMO	ECLIMO Sdn Bhd
SEB	Sarawak Energy Berhad
PETRONAS	Petronas Dagangan
Cyberview	Cyberview Sdn Bhd
Hong Leong YM	Hong Leong Yamaha Motor
KMM	Kawasaki Motors (Malaysia) Sdn Bhd
NEUTO	NEUTO Group Malaysia
Rapid Genesis	Rapid Genesis Sdn Bhd
Mercedes	Mercedes-Benz Malaysia
Honda	Honda Malaysia
E-Mas	ERL Maintenance Support Sdn Bhd
Scania	Scania (Malaysia) Sdn Bhd
Tiong Nam	Tiong Nam Logistics Solutions Sdn Bhd

Associations

MASAAM	Motorcycle & Scooter Assemblers and Distributors Association
ANGVA	Asia Pacific Natural Gas Vehicles Association
MGA	Malaysian Gas Association
MAA	Malaysian Automotive Association

NGOs/Communities Group

CETDEM	Centre for Environment Technology and Development Malaysia
Bike with Elena	Bike With Elena

Universities/Institutions

UMPEDAC	UM Power Energy Dedicated Advanced Centre

Low Carbon Mobility Blueprint

First published in year 2021