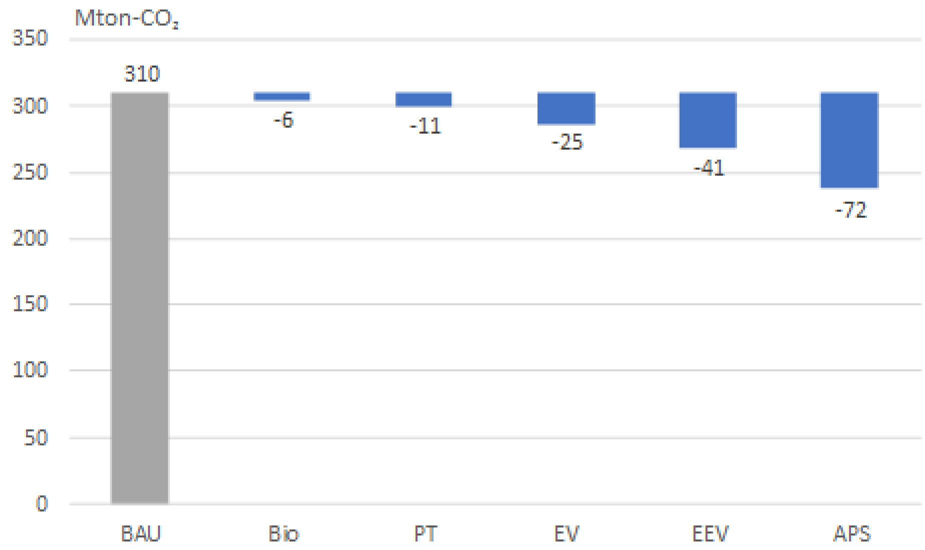
Chapter 5

Policy Recommendations

Referring to the result of the scenario analyses, the deployment of energy-efficient vehicles (EEV scenario) has the larger potential in reducing CO_2 emissions, followed by electric vehicles (EV scenario), public transport (PT scenario), and biofuels (bio scenario).

Figure 5.1 Potential of Reducing CO_2, by Scenario (2040)



APS = combination of all the scenarios, BAU = business-as-usual scenario, bio = assumes more biofuel supply; EEV = assumes energy-efficient vehicle deployment; EV = assumes EV deployment; Mt-CO_2eq = million tonnes of carbon dioxide equivalent, PT = assumes larger modal shift to public transport.

Source: Study team.

When classifying the options in two dimensions – reducing CO_2 and determining the time line of action – deployment of EEVs can be easily achieved. The next priority goes to public transport as it has a larger CO_2 reduction potential compared to biofuels, and lastly, the EVs. Although Malaysia can expect large CO_2 reductions, it needs to wait for reduced vehicle costs, spread of charging stations, and development of low-carbon electricity.

Table 5.1 Classification of CO_2 Reduction Scenarios in Two Dimensions

	CO_2 Reduction	Timeline of Action
Biofuel	Small	Short term
Public transport	Small	Short term
Electric vehicle	Medium	Long term
Energy-efficient vehicle	Large	Immediate

Source: Study team.

Following the above classification, this study discussed two parts to reduce CO_2 emission in the transport sector.

Part 1 Maximise use of public transport

Part 2 Deploy low emission vehicles

The first part is concerned with maximising use of public transport, such as high-speed railways, underground lines, light railways, and buses, which have higher energy efficiency than vehicles. It particularly suits large city and inter-city passenger and cargo transport. Considering that landmark railway projects are under way in Malaysia, the priority of recommendation is on how to increase ridership of, rather than suggest developing, public transport (recommendations 1 and 2 below).

Recommendation 1. Boost connectivity amongst various kinds of transportation

- To make the most use of upcoming railway projects, transport hubs are a key component to encourage people to use and shift to public transport

Recommendation 2. Provide last one mile mobility[13] using innovative technology, shared autonomous vehicles (SAVs)

- SAVs can provide people with ultimate access to transport hubs, such as railway stations or bus depots, which would accelerate modal shift.

Other recommendations to increase ridership of public transport

- Strictly implement parking regulations and conduct police patrols (park at lots or be fined)
- Restrict car driving within a certain zone.

[13] Last mile is a term used in transportation planning to describe the movement of people from a transportation hub to a final destination.

- Implement load pricing for a certain zone.
- Provide public transport with enough capacity.
- Construct comfortable (safe and clean) bicycle and pedestrian ways.

The second part is concerned with deploying low-emission vehicles. Although costlier than conventional internal combustion engine (ICE) vehicles, new vehicle technologies are emerging and becoming commercially available. Considering that the policy promoting EEVs was implemented in Malaysia after the National Transportation Plan 2014 and had resulted in EEVs accounting for 52% of new car sales in 2017,[14] the main recommendation is the difficult option of promoting EVs (recommendations 3, 4, and 5).

Recommendation 3. Take an integrated approach to increase low-emission vehicles

- Since all stakeholders, government, businesses, and the public have rules to deliver, they need to do their share in reducing CO_2 emissions.

Recommendation 4. Support zero-emission vehicles (ZEVs) to penetrate the market

- More diffusion of renewables is unavoidable.
- In the early stage of the ZEVs market, government support is indispensable.
- A governmental pilot project might bring a new perspective to the EV/FCEV market.

Recommendation 5. Set up smart power grids

- EV battery plays an important role in power grids, considering a massive introduction of renewables.

The following sections 5.1 to 5.5 discuss the details of recommendations 1 to 5.

5.1 Boosting connectivity amongst modes of land transport

Connectivity is essential in encouraging people to use public transportation more. In these days, the transport hub plays an important role for people to move easily and comfortably, and to shift to other modes of transport. Specific facilities of the transport hub include a railway station, bus terminal, free passage and stairs, and square in front of the station. For example,

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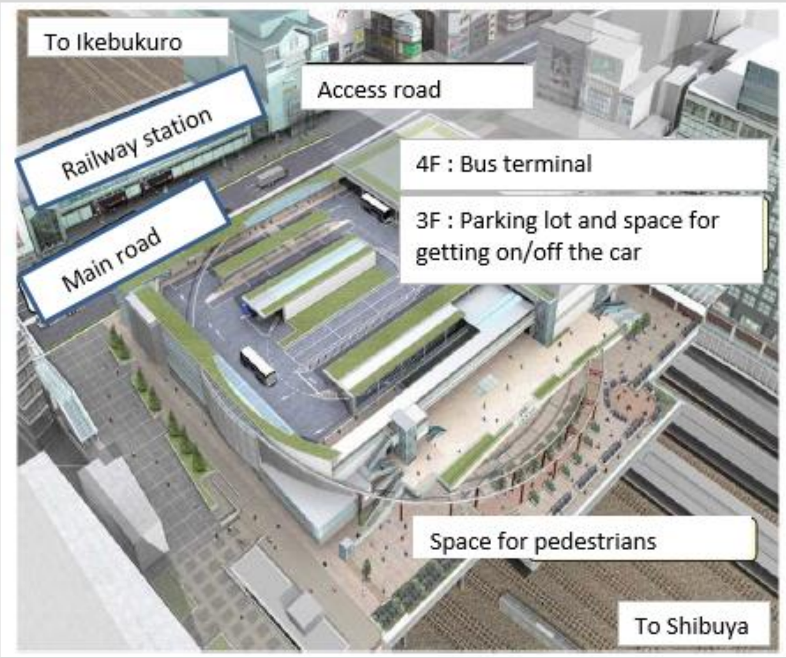
[14] Malaysia Automotive Institute, Technology Development in Transportation Sector, Malaysia, May 2018.

the station square is a facility connecting multiple transport modes. Recently, improvements have been made because of increased demand for more comfort and convenience. In addition, with urbanisation, required functions are also diversified. From the viewpoint of users, it is important to improve the transport hub to boost continuity of movement.

Box 5.1 Examples of Improving the Transport Hub in Japan

The biggest railway station in Japan, Shinjuku station, a large land transport system, which is convenient, comfortable, and user-friendly, is located in one place.



Easy to transit between LRT&Bus

Development of bus location system

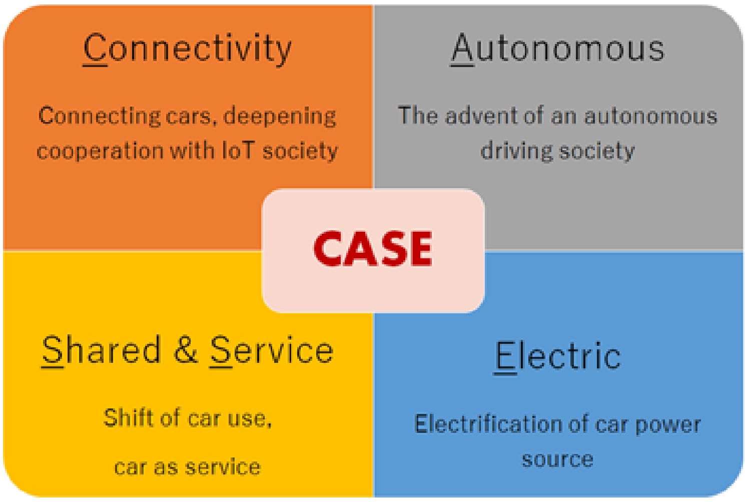
LRT = light rail transit.

Source: Ministry of Land, Infrastructure, Transport and Tourism (MLIT) website.

5.2 Improving Last 1-Mile Mobility to Promote Modal Shift

Drastic environment changes regarding automobiles, often referred to as 'CASE (connected, autonomous, shared, electric)', will lead to the transformation of the automobile- and mobility-related lifestyle as well as of the society. Autonomous, or self-driving or robotic, vehicles will affect future transportation. For a sustainable society, it is reasonable to make the most of SAVs.

Figure 5.2 Innovative Four Drives to Change Future Mobility



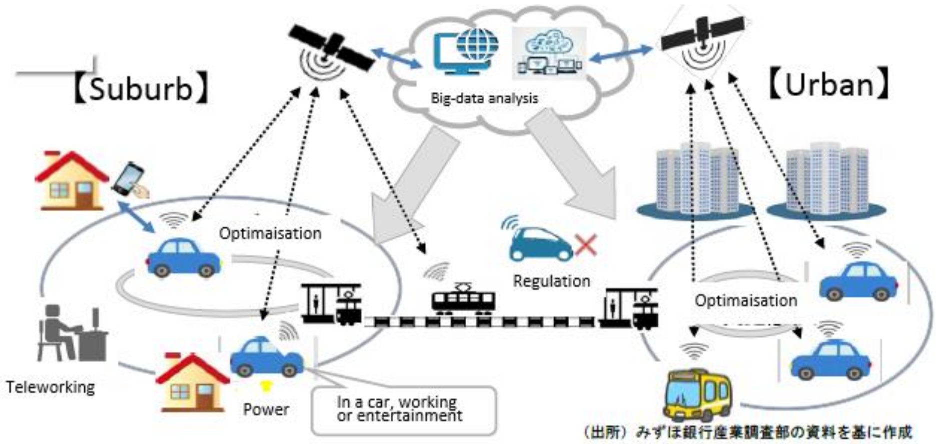
IoT = internet of things.
Source: IEEJ developed based on METI's Strategic Commission for the New Automotive Era on 18 April 2018.

In Malaysia, millions of people use their vehicles to commute, or they are obliged to do so because they do not have any other convenient and reasonable modes of transport. As for the-last-one-mile mobility to their home, workplace, school, or other places, SAVs, such as bus rapid transit, demand bases, robotic taxies, will provide access to the nearest transport and transit systems, which definitely encourages people to use public transportation more. As a result, road congestion will be mitigated, and the burden on the environment will be reduced.

SAVs are also expected to solve other administrative problems. Making the most of the existing infrastructure helps governments curb their investment in new infrastructure. SAVs are the vital piece that will not only save energy and reduce emissions but will also decongest highways, free up parking lots for other urban uses, cut transportation costs, and improve walkability and liveability. SAVs will also urge local businesses in Malaysia to enter the mobility service market and expand business opportunities.

In the automated driving society, robot taxies are constantly in operation, and people can move seamlessly without waiting (Figure 5.3). In Japan, for instance, car-sharing has been gaining popularity.

Figure 5.3 Autonomous Driving Society for the Future



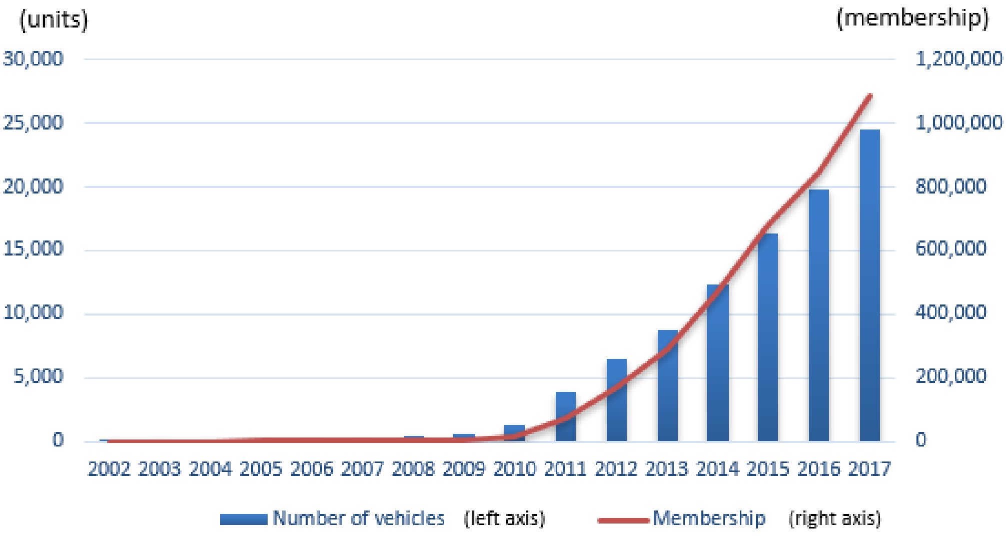
Source: IEEJ developed based on METI's Strategic Commission for the New Automotive Era on 18 April 2018.

The membership of car-sharing surpassed 1 million for the first time in 2017. The number has been growing by double digits for the past several years and is expected to continue to grow. The number of vehicles has reached 23,000 units, which means it doubled over the last 3 years. Especially in the urban areas, accessible cars near homes or workplaces are increasing, which helps car-sharing gain momentum. Even auto manufacturers are keen on entering the market.

As a worldwide trend, consumers' preference for cars has been shifting from ownership to convenience and ecological usage. The concept of sharing matches this trend. For example, Singapore's first electric car-sharing service was officially launched In December 2017, with 80 cars and 32 charging stations available for public use across the island (Aravindan, 2017). Not only in developed countries but in Thailand, Toyota launched a 2-year car-sharing project to study motorist behaviour in Bangkok in January 2018, using ultra-compact electric cars (Harman, 2018).

If Malaysia makes the most of 'CASE' trends, a huge reduction in CO_2 emissions might be achievable. What kind of sharing services is suitable or acceptable to people in Malaysia is dependent on various factors, such as accessibility to the public transport network, climate, or cultural and economic conditions. It is a good opportunity for Malaysia to latch on to the trend and technology related to it and formulate user-driven transport policies.

Figure 5.4 Car-Sharing: Number of Vehicles and Membership in Japan



Source: IEEJ developed based on the data from the Eco-Mobility Foundation, Japan.

5.3 Suggestions to Take Integrated Approach with the Four Pillars

Since automobiles emit the most CO_2, fuel efficiency must be improved. In Japan, ZEVs such as EVs and FCEVs are already on sale but the costs are still very high. When thinking about the overall social cost, various initiatives, known as the 'integrated approach', could be most effective and realistic in reducing CO_2 emissions. The integrated approach consists of four pillars as follows. The bottom line is that not only auto industries but the other players including government, drivers, and fuel suppliers are required to do their part.

a) Fuel-efficient vehicles by auto industry
   - Improvement of fuel economy
   - Development of next-generation vehicles

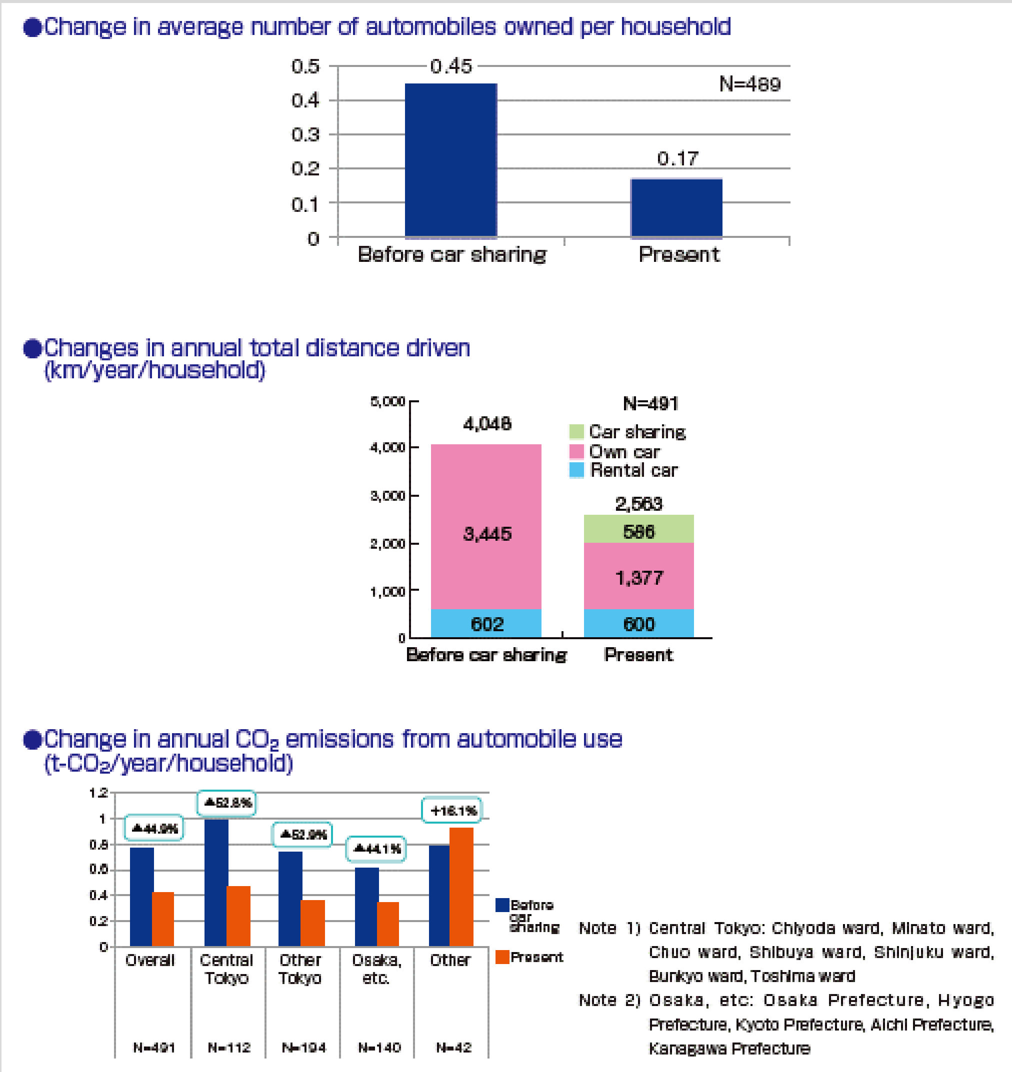
b) Efficient vehicle usage by driver
   - Practice of eco-driving
   - Improvement of load efficiency in truck use

c) Improving traffic flow by government
   - Electric toll collection
   - Intelligent transport system (ITS)

d) Diversified fuel supply by fuel supplier
   - Biofuel
   - Hydrogen fuel
   - Electricity supply

Box 5.2 Effectiveness of Car-Sharing on the Environment

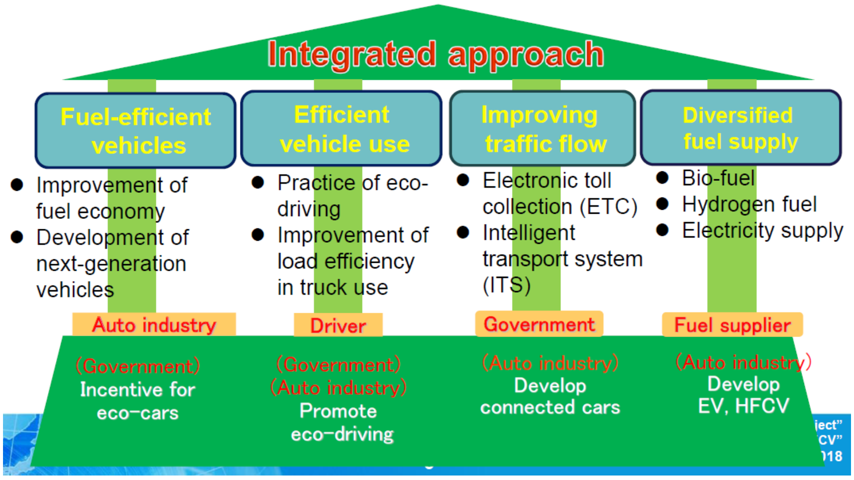
In 2012, the Eco-Mobility Foundation in Japan evaluated the effectiveness of car sharing at reducing environmental impact. A survey of car sharers was carried out with the cooperation of five major car-sharing operators. The survey found a decrease of over 60% in the number of cars owned per household after joining a car-sharing scheme, a decrease of just below 40% in average annual miles driven, and an average annual reduction in automobile CO_2 emissions of 0.34ton (45%).



CO_2 = carbon dioxide, t-CO_2 = ton of carbon dioxide.

Source: Eco-Mobility Foundation (2017).

Figure 5.5 Integrated Approach – Four Pillars



EV = electric vehicle, HFCV = hydrogen fuel cell vehicle.

Source: First workshop on 22 February 2018 presented by JAMA.

5.4 Support Zero-Emission Vehicles to Penetrate the Market

The reason EVs are drawing attention worldwide is that they help control CO_2 emissions since they do not emit CO_2 when running.

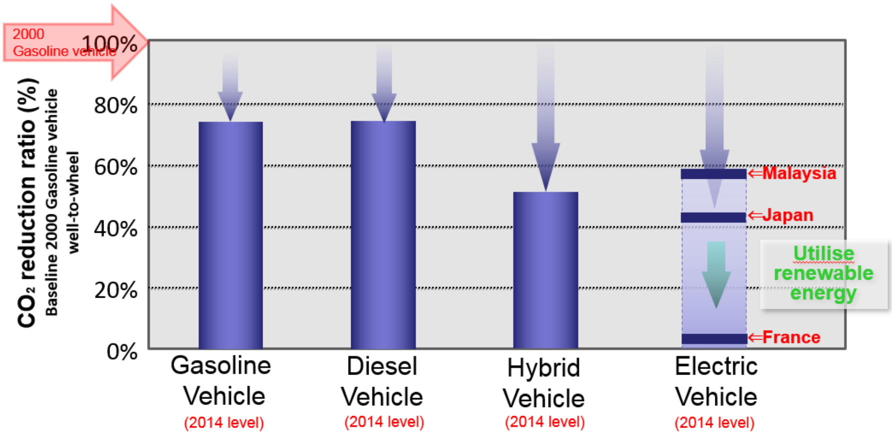
However, there are some points to be aware of. The impact on CO_2 emissions reduction will change widely, depending on how electricity is generated as an energy source for EVs. No matter how much emission while traveling is zero, there is no point if electricity is produced by burning fossil fuels.

On the other hand, if electricity for EVs can be generated only by zero-emission power supply, which does not emit CO_2, it will be possible to reduce emissions to zero even during car travel. For zero-emission power sources, renewable energy – such as hydroelectric, solar photovoltaic, and wind power generation – or fossil-fuelled power generation equipped with carbon capture and storage or nuclear power generation can be considered. Widespread use of EVs needs to be in conjunction with the transformation of power supply.

It is also important to prioritise the introduction of ZEVs. If vehicles with a high mileage such as buses or taxies are fuelled with renewable energy, CO_2 emission will be greatly reduced.

In Malaysia, renewable energy in power generation is expected to increase 2.3 times from 2015 to 2040. The promotion of automobiles that use renewable electricity can be a key driver in reducing CO_2 emissions.

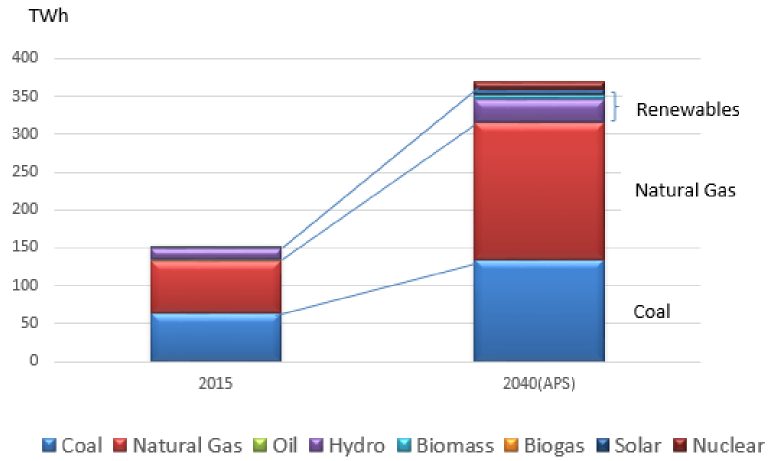
Figure 5.6 Well-to-Wheel CO_2 Emissions in Vehicle Type



CO_2 = carbon dioxide.

Source: First workshop on 22 February 2018 presented by JAMA.

Figure 5.7 Power Generation Mix Forecast for Malaysia



APS = alternative policy scenario, TWh = terawatt-hour.

Source: IEEJ developed based on the data proposed from the Energy Commission (ST).

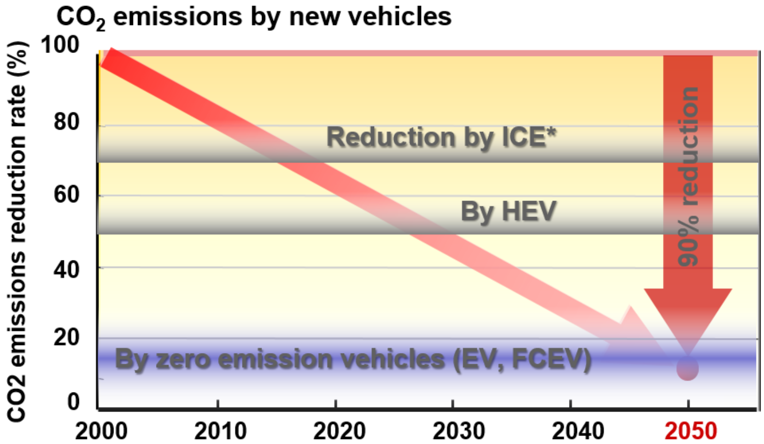
Figure 5.8 Illustration of EV Charging by Solar Power

Source: METI website.

On the other hand, it is not realistic to shift directly from ICEs to EVs or FCEVs in a short time. The price of EVs and FCEVs is still high compared to conventional ICEs, and it takes time and is costly to develop charging infrastructure. Therefore, gradually shifting from ICEs to EVs/FCEVs through fuel-efficiency improved ICE and hybrid (HEV) is desirable.

To popularise EVs and FCEVs and spread charging infrastructure, government should provide some incentives, such as tax exemptions or subsidies, especially during the initial stage.

Figure 5.9 Trajectory towards CO_2 Reduction



EV = electric vehicle, FCEV = fuel cell vehicle, HEV = hybrid vehicle, ICE = internal combustion engine.

Source: First workshop on 22 February 2018 presented by JAMA.

Figure 5.10 Examples of In-Use EV Incentive

Incentive for In-Use EV	Country, Region
Free parking	Norway, California, Amsterdam
Free charging	London, Amsterdam
Expressway toll (free, discount)	Norway, (Japan in the past)
Ferry fare (free)	Norway
HOV*/bus lanes *Open only to vehicles with designated numbers of occupants	Norway, California
Exemption from entry ban	London
Number plate (free)	China

HOV = high occupancy vehicle.

Source: First workshop on 22 February 2018 presented by JAMA.

5.5 Setting Up Smart Power Grids Incorporating EV batteries

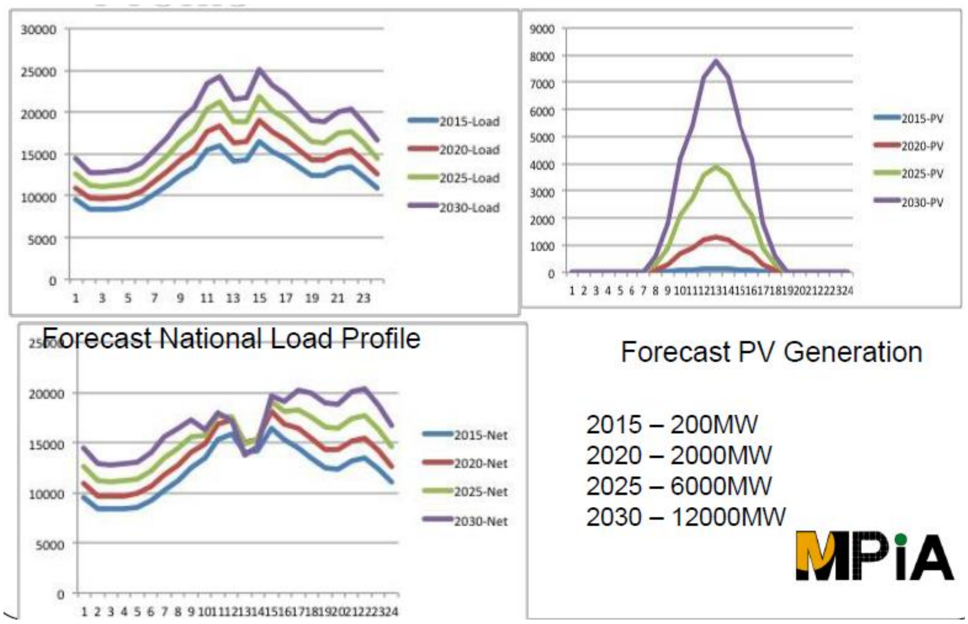
EVs are also one important component of the next-generation electricity network. The key is the storage battery installed in the EV. One idea is to use the storage battery to store 'surplus electricity' and extract electricity when power is insufficient.

Along with the introduction of large amounts of renewable energy, several problems could negatively influence power grid or distribution system stability – frequency, maintenance, voltage, and other issues. The influence of massive introduction of solar photovoltaic and wind power can be serious. Massive introduction of renewables often causes the timing imbalance between peak demand and renewable energy production.

The problem of what is known as the 'duck curve' has appeared to be a big challenge in several countries or regions worldwide. Malaysia also needs to prepare for such a problem in line with introducing massive renewables.

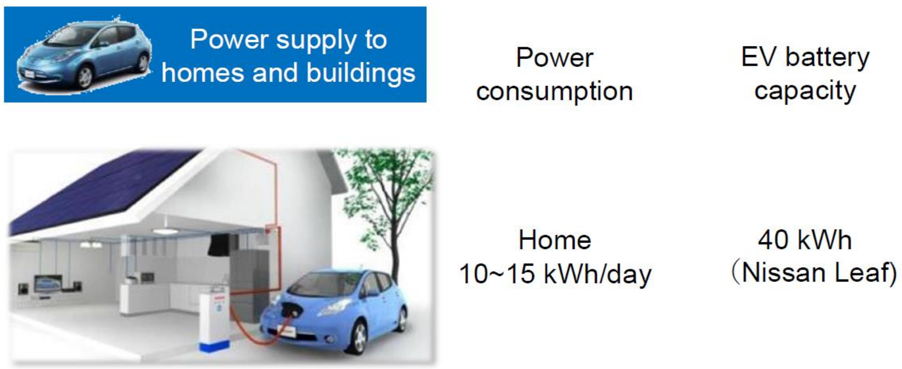
One solution to this is the power system in the storage battery in the EV, which has been drawing much attention these days, namely vehicle-to-grid (V2G). V2G technologies can contribute to limiting the need for grid upgrades. If the battery in the EV could somehow be priced (the grid operator would pay for using the battery in the EV to stabilise the grid), the real cost of EVs could be reduced and thereby incentivise people to buy EVs.

Figure 5.11 Malaysia's National Load Profile



MW = megawatt, PV = photovoltaic.
Source: Solar PV –The Game Changer in Malaysian Electricity Supply Industry, Malaysian Photovoltaic Industry Association (2015).

Figure 5.12 EV Battery Usable as Storage Battery



EV = electric vehicle, kWh = kilowatt-hour.
Source: First workshop on 22 February 2018 presented by JAMA.

References

Chapter 2: Energy and Transport in Malaysia

IEEJ (2016), IEEJ Report, Evaluation of future prospects and GHG emission reduction targets of ASEAN countries, November 2016, Japan. https://eneken.ieej.or.jp/data/7010.pdf (in Japanese)

Ministry of Energy, Green Technology and Water (2017), Green Technology Master Plan Malaysia 2017–2030, Putrajaya, Malaysia: Ministry of Energy, Green Technology and Water.

SPAD (2018), 'Land Public Transport at the Forefront of Transformation,' SPAD website, https://www.spad.gov.my/media-centre/media-releases/2018/land-public-transport-forefront-transformation (accessed 6 June 2018).

Energy Commission (2018), *National Energy Balance 2016*. Putrajaya, Malaysia: Ministry of Energy, Green Technology and Water.

JETRO (2018), https://www.jetro.go.jp/biz/areareports/2018/16a7442989a3a3e7.html (in Japanese).

IEA (2017) World Energy Balances 2017. Paris: International Energy Agency.

Malaysia, Automotive Institute http://mai.org.my/

Malaysia Energy Commission, https://www.st.gov.my/

Malaysian Photovoltaic Industry Association (2015).Solar PV –The Game Changer in Malaysian Electricity Supply Industryhttps://www.st.gov.my/ms/contents/presentations/solar/3.%20Presentation%20from%20MPIA.pdf

Source: Ministry of Transport and Department of Statistics Malaysia,

http://www.mot.gov.my/en/resources/yearly-statisti.

Chapter 3: Promising Solutions for Reduced CO_2 Emissions from Automobiles

International Energy Agency (IEA) (2018), *Global EV Outlook 2018: Towards cross-modal electrification*. Paris: IEA.

Ministry of Economy, Trade and Industry (METI) (2014), Automobile Industry Strategy 2014, Tokyo: METI.

Ministry of Economy, Trade and Industry (METI) (2016), EV/PHV Roadmap 2016, Tokyo: METI.

Chapter 4: Scenario Analysis towards Reduced CO_2 Emissions in Malaysia

Electrical and Mechanical Services Department (EMSD) website, http://ecib.emsd.gov.hk/en/indicator_trp.htm (accessed 2 March 2018).

Department of Statistics Malaysia, https://www.dosm.gov.my/v1/

Chapter 5: Policy Recommendations

Aravindan, A. (2017), 'Singapore's electric car-sharing program hits the road', *Reuters,* 12 December 2017, https://www.reuters.com/article/us-singapore-electricvehicles/singapores-electric-car-sharing-program-hits-the-road-idUSKBN1E60OF (accessed 6 May 2018).

Eco-Mobility Foundation (2017), 'Transport and Environment in Japan,' Foundation for Promoting Personal Mobility and Ecological Transportation, http://www.ecomo.or.jp/english/tej.html (accessed 6 June 2018).

Harman, A. (2018), 'Car-Sharing Program in Bangkok', *WardsAuto,* 9 January 2018, http://wardsauto.com/industry/toyota-thailand-tests-car-sharing-program-bangkok (accessed 25 May 2018).

Malaysian Photovoltaic Industry Association (2015), 'Solar PV – The Game Changer in Malaysian Electricity Supply Industry', February 2015.

MLIT (2008), 'Transport and Tourism', http://www.mlit.go.jp/hakusyo/mlit/hakusho/h20/html/j1211200.html (accessed 4 April 2018).

Agenda at Workshops

The 1st Workshop Meeting of ERIA Research Project FY2017

on 'Sustainable Development of Transport Sector: Malaysia'

Theme: Upcoming Green Automobiles towards CO_2 Reduction

Date: 22 February 2018

Venue: The Everly Hotel, Putrajaya, Malaysia

1. *Final Agenda*

09:00–09:35 *Registration*

09:35–10:00 Opening Session

Welcome Remarks

*by **YBhg Datuk Badriyah Binti Ab Malek**, Deputy Secretary General (Energy and Green Technology), Ministry of Energy, Green Technology and Water (KeTTHA), Malaysia*

Opening Remarks

*by **Mr Shigeru Kimura**, Special Advisor to President for Energy Affairs, Energy Unit, Research Department, Economic Research Institute for ASEAN and East Asia (ERIA)*

Photo Session

Adoption of Agenda

10:00–10:20 Session 1: Scene Setting Presentation

*by **Mr Ichiro Kutani**, Leader of the Working Group, Senior Economist, Manager of Global Energy Group 1, Strategy Research Unit, The Institute of Energy Economics, Japan (IEEJ), Japan*

10:20–10:40 *Coffee Break*

10:40–11:15 Session 2: The Current Public Transportation Policy and Upcoming Challenges, Malaysia

*by **Mr Na'el Kamil Bin Nor Hisham,** Manager of Policy, Planning and Research Division, Land Public Transport Commission (SPAD), Malaysia* (30 min. presentation)

11:15–11:40 Session 3: The Current Road Transport Policy and Upcoming Challenges, Malaysia

*by **Mr P. Jeevanath s/o Paliah**, Senior Principal Assistant Secretary, Logistic and Land Transport Division, Ministry of Transport (MOT), Malaysia*

(30 min. presentation)

11:40–11:55 Session 4: Scenario Setting of Model Analysis for the 2nd Workshop

*by **Mr Zaharin Zulkifli**, Senior Regulatory Officer, Energy Management and Service Quality Development Department, Energy Commission of Malaysia (ST), Malaysia* (20 min. presentation)

11:55–12:25 Discussion on Sessions 1 to 4

12:25–13:25 Lunch Break

13:25–13:30 Session 5:Trends and Targets of CO_2 Emissions in Japan

*by **Mr Hiroshi Kondo**, Senior Coordinator, Global Energy Group 1, Strategy Research Unit, IEEJ, Japan*

13:30–14:05 Session 6: Development of Environment-Friendly Vehicles in Japan

*by **Mr Noboru Oba**, Chairman of Climate Change Subcommittee, Japan Automobile Manufacturers Association, Inc. (JAMA)* (25 min. presentation)

14:05–14:35 Session 7: Development of FCV & EV at Toyota Motor Corp.

*by **Mr Takayuki Kusajima**, Project General Manager, Corporate Affairs Department, Toyota Motor Corporation, Japan* (25 min. presentation)

14:35–15:20 Discussion on Sessions 5 to 7

15:20–15:40 Coffee Break

15:40–16:05 Session 8: Prospects and Challenges of FCV & EV

*by **Prof Koichi Iwama**, Professor, Department of Economics, Wako University, Japan* (25 min. presentation)

16:05–16:30 Session 9: Challenges of EV Charging Infrastructure

*by **Mr Akihiko Kido**, Research Director, FC-EV Research Division, Japan Automobile Research Institute (JARI), Japan*

(25 min. presentation)

16:30–16:50 Whole Discussion, including Sessions 8 and 9

16:50– Wrap-up, Way Forward, and Closing

*by **Mr. Ichiro Kutani**, Leader of the WG, IEEJ, Japan*

*by **Mr. Shigeru Kimura**, Special Advisor, ERIA*

The 2nd Workshop of ERIA Research Project FY2017
on 'Sustainable Development of Transport Sector: Malaysia'
Theme: What sustainable mobility, led by
Intelligent Transport Systems (ITS), aims for
Date: 14 May 2018
Venue: The Everly Hotel, Putrajaya, Malaysia

2. *Final Agenda*

09:00–09:30 *Registration*

09:30–09:50 Opening Session

Welcome Remarks

*by **Mdm Inu Baizura binti Mohamad Zain**, Undersecretary, Strategic Planning & International Relation Division, Ministry of Energy Green Technology and Water (KeTTHA), Malaysia*

*by **Mr Shigeru Kimura**, Special Advisor to President for Energy Affairs, Energy Unit, Research Department, Economic Research Institute for ASEAN and East Asia (ERIA)*

Opening Remarks

*by **Mr Ichiro Kutani**, Leader of the Project, Assistant to Managing Director, Senior Economist, Manager of Global Energy Group 1, Strategy Research Unit, The Institute of Energy Economic, Japan (IEEJ), Japan*

Adoption of Agenda

09:50–09:55 Photo Session

09:55–11:10 Session 1: Sustainable Mobility that Contributes to CO_2 Reduction, taking Advantage of ITS

*by **Dr Takahiro Suzuki**, Professor, Planning Office for Development, New Industry Creation Hatchery Center (NICHe), Tohoku University, Japan*

(45 min. presentation)

11:10–11:35 Photo Session and Coffee Break

11:35–12:30 Session 2: Technology Development in Transport Sector, Malaysia

*by **Dr Ahmad Zainal Abidin**, Director of Innovation Centre, Malaysia Automotive Institute (MAI), Malaysia* (45 min. presentation)

Discussion

12:30–13:35 *Lunch Break*

13:35–13:45 Session 3: Key Approaches to a Reduction of CO_2 Emissions from Automobiles

*by **Mr Hiroshi Kondo**, Senior Coordinator, Global Energy Group 1, Strategy Research Unit, IEEJ, Japan*

13:45–14:45 Session 4: Digital Transformation of Transportation

by ***Mr Walter Lee****, Evangelist and Government Relations Leader, Global Safety Division, NEC Corporation, Singapore* (1 hour presentation)

Discussion

14:45–15:00 Coffee Break

15:00–16:10 Session 5: Results of Model Analysis and Malaysia's Strategies to a Reduction of CO_2 Emissions

by ***Mr Zaharin Zulkifli****, Senior Regulatory Officer, Energy Management and Service Quality Development Department, Energy Commission of Malaysia (ST), Malaysia* (45 min. presentation)

Discussion

16:10–16:35 Wrap-up, Way Forward, and Closing

by ***Mr Shigeru Kimura****, ERIA*

by ***Mr Ichiro Kutani****, Leader of the Project, IEEJ, Japan*