Fuel Economy Labelling of LDVs in Nepal

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ACRONYMS

CC	Cubic Cylinder
DOTM	Department of Transport Management
EPA	Environmental Protection Agency
FE	Fuel Economy
FELS	Fuel Economy Labelling Scheme
FESR	Fuel Economy Star Rating
FEPIT	Fuel Economy Policy Implementation Tool
GFEI	Global Fuel Economy Initiative
HSU	Hartridge Smoke Unit
LDV	Light-Duty Vehicles
MIIT	Ministry of Industry and Information Technology
PESLP	Philippine Energy Standards and Labeling Program
WLTP	Worldwide Harmonised Light Vehicle Test Procedure
VCA	Vehicle Certification Agency
VET	Vehicle Emission Testing
VFEL	Vehicle Fuel and Economy Labeling

Contents

1. Introduction

The rapid growth of passenger vehicle ownership is one of the main drivers of the increase in fuel consumption, greenhouse gases, and pollutant emissions around the world over the past decades. According to (EPA, 2017), transportation contributed to approximately 28.9 percent of greenhouse gas emissions. Because of rapid urbanization, economic growth, and higher demand for mobility, fuel consumption by transport is expected to increase by more than 5% per year until 2030.

Fuel economy policies and measures are essential for fuel security and costs, climate change, and air pollution control. With implementations of such policies and measures, there could be up to 16% reductions in fuel and CO_2 emissions if applied to light-duty vehicles (LDVs) and up to 26% if applied to both LDVs and high duty vehicles (HDVs)(GFEI, 2010). Therefore, governments around the world are looking for ways to increase consumer's use of fuel-efficient vehicles. One of the most effective ways to provide this information out to the consumers is in the form of labels. The "fuel economy label" refers to information that is displayed about the car in the showroom, online or through other media. It is associated with a consumer information campaign. The aim of the Vehicle labeling scheme for improved fuel economy is to allow consumers to make a more informed choice when purchasing a vehicle. It allows consumers to take into account the effect that fuel efficiency will have on the environment and their fuel costs, which stimulate the supply and purchase of more fuel-efficient vehicles. Vehicle fuel economy labeling has impacts on raising consumer awareness and enabling other policies, i.e., Fuel economy standards, and fiscal incentives. It influences consumer purchase decisions and manufacturers' technology investment strategy. On the whole, it will promote vehicle fuel economy.

A label for vehicles aimed to inform consumers about the fuel economy should be:

- Simple and easily understandable by the purchasers
- Insensitive for manipulation, so that it is possible to change the classification of a model by simple modification by the manufacturer
- Workable standardized fuel consumption data based on available vehicles characteristics such as mass, displacement, external dimension, engine capacity, specific engine power, and specific carrying capacity
- Durable so that the current and future cars are classified correctly
- Conspicuous and well known to gain buyer's attention
- Adjustable to technology developments in fuel economy
- Accepted and supported by consumers, authorities, automobile, and consumer association, if feasible, also by car dealers and automobile industry (Fickl & Raimund 1999).

Different countries have come up with a different vehicle fuel economy label schemes. The fuel economy of the vehicle is generally displayed on the window sticker of all new light-duty vehicles. The label/ data provided in these vehicles is informative, easily accessible, and transparent so that the consumers can make more informed choices regarding fuel efficiency when buying a new vehicle. In most of the countries, vehicle labeling includes fuel consumption and carbon emissions.

A country like Nepal is increasingly dependent on imported fuels, where the fuel prices are volatile putting pressure on national budgets. Nepal does not manufacture vehicles and imports most of the vehicles from India. Regarding, vehicle fuel economy labeling schemes (VFEL) of Nepal, it needs to follow India's labeling schemes. Since Nepal does not have its VFEL, it has to adopt labelling information/schemes from LDV manufacturers on fuel economy and fuel emission across the border.

2. Objective

The main objectives to be achieved from Fuel Economy Labeling are:

- To make consumers/buyers aware of fuel efficiency and average CO_2 emission to influence their purchasing decision towards a more fuel/energy-efficient and environment-friendly vehicles
- To get more fuel-efficient vehicles on the market through a combination of efficiency standards, labels, tax increases and development of new technologies

3. Fuel Economy Labeling in Developed and Developing Countries

Fuel economy labeling has been developed and effective in various developed countries like the USA, United Kingdom (UK), European countries, Singapore, South Korea, China, Thailand, India, Chile, Vietnam, Philippines and others. In the USA, fuel economy/consumption labeling programs was implemented long ago. The USA has fuel economy labeling on flexible-fuel vehicles, gasoline vehicles, electricity-gasoline (plug-in hybrid) vehicles, electric vehicles. The fuel economy label is put on the window of every new LDVs sold in the USA. In the UK, the vehicle fuel economy for passenger cars first came into force from 21st November 2001. From January 2019, the fuel and energy consumption information provided to consumers was based on the Worldwide Harmonised Light Vehicle Test Procedure (WLTP), a laboratory

test used to measure fuel consumption and CO_2 emissions from passenger cars, as well as their pollutant emissions(VCA). The EU Parliament in 2000 had introduced legislation requiring that information on fuel economy and CO_2 emissions be provided to consumers for all new passenger cars. It uses scaling systems with colour code from 'A' (Best) to 'G' (Worst) based on CO_2 emission per kilometer.

Singapore launched a voluntary Fuel Economy Labeling Scheme (FELS) to provide fuel economy information to buyers of passenger cars in 2003. Since 2013 there is a scheme known as the Fuel Economy Labelling Scheme (FELS) implemented by the Singapore Environment Council(LTA, 2013). The schemes based on fuel consumption and CO_2 emissions. In South Korea, the vehicle fuel labelling scheme was introduced in 2005, where all cars were required to show a label indicating the cars fuel economy ranking from 1-5 and its fuel economy in km/l attached on the rear or flank side of the vehicles to be visible by the consumers.

Chile adopted a mandatory fuel economy labeling scheme from February 2013, becoming the first Latin American country to adopt such a scheme. The label provides information on CO_2 emissions, fuel economy (highway, city, and combined), model, and manufacturer.

Chinese Ministry of Industry and Information Technology (MIIT) officially implemented China's first "light vehicle fuel consumption labeling regulations" in July 2009 with the mission to strengthen the automobile industry's energy management and related sales impacts. Thailand made a new scheme mandatory for all manufacturers and importers to display an Eco-Sticker on windscreens of all light-duty vehicles (LDVs) in order to inform buyers about the emissions, safety, and fuel economy rating of new cars. The Eco-Sticker of Thailand includes CO_2 ratings, fuel economy, and vehicle emission standards. Similarly, other information on safety and vehicle manufacturer is also provided on the Eco-Sticker.In Vietnam, from 1 January 2018, all vehicles with nine seats or less require new fuel-efficiency labels. The car manufacturers or importers were allowed to publish their fuel economy data for car models tested in Vietnam or reputable foreign laboratories.

In India, Star Labelling Program for Passenger Cars was set mandatory from April 2013 to enhance improvement in fuel efficiency and accordance with the energy consumption standards and to provide the consumer an informed choice about the fuel-saving and thereby to save the cost of the potential vehicle(P. T. o. India, 2012). The star-rating program is based on a five-star scale, with five being

the most efficient and one the least in order to help compare the fuel efficiency of different car models. Although set mandatory in 2013, Fuel Economy Star Rating (FESR) label was adhered from 1st April 2016. According to the principle rules published in the Gazette of India, every manufacturer/importer should fix the FESR label and the dealer should prominently display it at the point of sale. In case vehicles are powered with more than one fuel (CNG/LPG), the FESR label shall be based on the test conducted in the LPG/CNG mode as applicable. The International Centre shall authorize the usage of labels and numbers for Automotive Technology, Manesar, Haryana(T. G. o. India, 2016).

The Vehicle Fuel and Economy Labeling (VFEL) Program is part of the Philippine government's Philippine Energy Standards and Labeling Program (PESLP) to be implemented voluntarily for 1 to 2 years beginning 2019, which aims to promote the efficient use of energy by empowering consumers through the provision of information on energy-consuming products(GFEI, 2018). The VFEL guidelines for light-duty vehicles (LDVs) in Philippines were finalized in early 2019 after a series of consultations with the private sector representatives consisting of vehicle manufacturers, importers, and dealers, together with relevant government agencies such as the Department of Transportation, Department of Trade and Industry, and the Department of Environment and Natural Resources, and non-government and academic organizations. In the Vehicle Fuel and Economy Labeling, the vehicles need to have clear energy labels showing fuel economy ratings (in km/L or L/100Km) and a star rating scale, which informs consumers about the fuel efficiency of the vehicles and allow them to consider potential fuel savings while buying a vehicle(Almonares).

4. Fuel Economy Standard in Nepal

The baseline fuel economy of Nepal was studied to develop a baseline fuel economy of LDVs in Nepal. The study was based on the type of LDVs registered in the Department of Transport Management (DOTM) in 2005, 2008, and continued till 2016 at a periodic difference of 2 years. The methodological guideline of GFEI was followed to obtain the baseline fuel economy of Nepal.

The vehicle segregation based on engine capacity shows that 69% of the vehicle registered in the analysis period were below 1500cc capacity. However, the weighted average displacement range of LDVs in Nepal was estimated to be 1,538 cc attributed to the higher engine capacity of the jeep, pickup, and microbus. Since engine capacity is also one of the attributes affecting fuel economy, it is

crucial to analyze the type of vehicles imported in Nepal. Besides, the type of fuel used by vehicles is one of the major factors affecting the fuel economy. The baseline study shows that 68% of registered vehicles are petrol operated and the rest are diesel operated. The fuel economy of the vehicle is also affected by other factors like vehicle make and model, model production year, and year of first registration. Based on those factors, the vehicle fuel economy of LDVs was estimated. It shows a gradual improvement in fuel economy from 2005 to 2016 at an annual rate of 1.9%. The average liter gasoline-equivalent (Lge) per 100 km was 6.98 in 2005 and improved to 5.81 in 2016. There was an improvement in fuel economy by approximately 20% from 2005. In 2005 the fuel economy of diesel vehicles was 9.72 Lge/100km, and that of petrol vehicle was 6.06 Lge/100km, which improved to 7.06 Lge/100km and 5.12 Lge/100km respectively in 2016. This reduction is due to the import of fuel-efficient vehicles manufactured in neighboring countries. Since the auto market of Nepal depends entirely on the import, the fuel efficiency of Nepal also depends on the fuel economy policy of the exporting countries. The average fuel economy of LDVs of Nepal was thus estimated to be 6.23 Lge/100km.

Based on the baseline study, the fuel economy of LDVs was projected until 2030 to estimate the effect of change in fiscal policy on the overall fuel economy. The Fuel Economy Policy Implementation Tool (FEPIT) was used to evaluate the impact of fiscal policies such as registration tax, circulation tax, fuel tax, vehicle registration composition, and also the possible market entry of battery electric vehicles in Nepal.

The vehicle composition as per the fuel economy in 2016 shows that 32% of registered vehicles have fuel economy between 4-5 Lge/100km, 28% vehicles between 5-6 Lge/100km, 15% vehicles between 6-7 Lge/100km and the rest of the vehicles have fuel economy higher than 7 Lge/100km. The future projection of composition based on the endogenous changing of vehicle composition in past years shows that in 2030 vehicles with FE 4-6 Lge/100km will dominate the auto market in Nepal. The corresponding change in fuel economy due to registration composition shows that the fuel economy will improve from 5.9 Lge/100km in 2016 to 5.1 Lge/100km in 2030 when there is no policy intervention. However, if the present improvement rate of -1.89% from 2005-2016 continued, the fuel economy of LDVs will be 4.5 Lge/100km by 2030. However, the value still does not meet the GFEI target to reduce fuel consumption by 50% from the 2005 level. In order to follow the GFEI target by Nepal, stringent policy intervention is necessary. The penetration of electric vehicles by 30% by 2030 can be one of the alternative policies as it shows the improvement of fuel economy to 3.72

Lge/100km by 2030. However, even at this rate, the fuel economy in 2030 is 6% lower than the GFEI specific target of 50% reduction by 2030 from the 2005 baseline. In order to enhance fuel economy by 50% from the 2005 baseline value, the fuel economy should come down to 3.48 Lge/100km. Literature shows that in order to enhance the fuel economy below 4 Lge/100km, there require robust measures of hybridization and electrification.

The impact of current fiscal policies such as registration tax and circulation tax shows the nominal effect on fuel economy. However, the Nepal government recently imposed a new registration tax system as road construction fees from the Fiscal Year 2019-20. The new system imposed the registration tax based on engine capacity. The registration tax for vehicles with an engine capacity lower than 2,000 cc are imposed with 8% of its vehicle price, and vehicles with engine capacity higher than 2,000 cc are imposed with 10% of its vehicle price (DOTM, 2019). The impact of the new registration tax system shows a significant change in the fuel economy and even meets the GFEI target. In this policy scenario, the fuel economy and CO_2 emission in 2030 are projected to be 3.28 Lge/100km and 77.78 g/km respectively.

5. Fiscal Policy Options

5.1 FE regulation standard

Studies have shown that fuel economy standard regulation has a direct impact on the penetration of electric vehicles in the market. (Fritz, Plötz, and Funke (2019), in their study, shows that there is a significant increase in Plug-in electric vehicles as a result of imposing fuel economy standards. Since the automobile market in Nepal entirely depends upon imports, the international market trend determines the fuel economy of Nepal. Thus it poses an opportunity to limit the import vehicles based on its rated fuel economy as standardized in Nepal. Nepal's fuel economy and emission standards should be in line with FE standards of neighboring countries from where the major share of LDVs are imported.

5.2 Fuel price adjustment

Studies have shown that fuel price significantly affects fuel consumption and total passenger miles traveled. Consumers shift to more fuel-efficient vehicles either by purchasing new fuel-efficient vehicles or by dumping high fuel-intensive vehicles into scrappage. Works of literature have shown that one dollar increase in gasoline price increases fuel economy by 1.08 miles per gallon, and there is

a 25% shift from fuel in-efficient SUVs to efficient one and 40% decline in the market share(Marrouch & Mourad, 2019). Thus, adjusting fuel prices is also one of the essential fiscal policies on the road to improving fuel economy standards.

5.3 Duty and Tax Restructure

Registration tax and circulation tax also play a significant role in improving fuel economy standards. However, in Nepal, the registration tax is very nominal and shows insignificance in fuel economy standard. Even though the circulation tax is high, the effect is still lower on FE. There is no timely revision in Nepal's duty structure on petroleum products for the past several years. Besides, adjusting the tax structure based on fuel economy rather than engine capacity might urge people to shift to fuel-efficient vehicles as they will be aware of the benefits from fuel economy as well as tax fee

5.4 Fuel Tax

In order to reduce CO_2 emissions and achieve the GFEI target, it is necessary to discourage the use of diesel vehicles. It can be achieved by imposing higher taxes on private diesel vehicles compared to petrol vehicles.

Nepal has to adjust Customs duties, excise duties on petrol and diesel bringing them at par with duties and taxes in India so that Nepal's domestic prices on petroleum products are slightly higher than prices across the border in India which was a couple of years before so that there is no outflow of petroleum products from Nepal due to open border.

6. Status of Vehicular Emission Test in Nepal

New vehicle registration in Nepal is increasing at an unprecedented growth rate of 20% annually during the last decade (DOTM, 2018). There are more than 3 million vehicles already registered in the country. Apart from checking CO and HC for petrol engine vehicles and Hartridge Smoke Unit (HSU) for diesel engine vehicles, other parameters are hardly checked in the country. The emission tests, though mandatory to be done every year, are conducted in stationary vehicles, and the enforcement and compliance are fragile and needy.

Due to a small automobile market, vehicle manufacturing in the country cannot be envisaged for the current period. However, vehicle importers, distributors, and dealers can display the fuel economy and CO_2 emissions labels supplied by

the manufacturers at the displays at the points of sales and marketing brochures of the vehicles. It provides information to the consumers about the fuel economy and emissions labels of the vehicles they select. Besides, this kind of label even helps consumers in their decision-making. Fuel Economy and Emission Labels, thus displayed, will provide overall fuel efficiency and environmental impact information compared to average vehicle available in the market.

6.1 Vehicle Emission Testing (VET) Lab in Nepal

Vehicular emission constitutes around 38% of total emissions in Kathmandu alone (JICA, 2017). Motor vehicles are emerging as the largest source of urban air pollution in growing cities. A recent random roadside test at Balkumari, Kathmandu, showed that 29% of vehicles failed an emission test[1]. The increasing trend of vehicle fleet and weak enforcement of emission control mechanisms is posing a threat to the environment and human health. Thus, a stringent vehicular emission controlling mechanism is one of the vital tasks for improving the air quality of the country.

The emission control mechanism primarily constitutes a set of standards and a physical facility – Vehicular emission testing center, that checks if the standards are met. Vehicular emission testing is a system designed to control and reduce vehicular emission, mainly from Internal Combustion Engines. Three emission test centers are existing in Nepal (Ekantakuna, Sano Bharyang, and Bhaktapur), all situated in Kathmandu valley (Dhital). However, there is no strict emission test requirement, and those vehicles which do not meet the standards are also free to ply in the streets. VET is also not required for two-wheelers (motorcycles) that constitute almost 78% of total vehicle registration. As per Nepal Vehicle Mass Emission Standards, 2069, all the vehicles plying in Nepal require EURO III fuel standard, but there is no such testing laboratory for petroleum fuels.

The vehicular population is increasing year by year, but the emission control mechanism is not being stringent. Therefore, the Government of Nepal must enforce mandatory vehicle emission tests for all the vehicles, including two-wheelers and heavy-duty vehicles. It thus necessitates the establishment of at least a testing lab in all seven provinces of Nepal to ease out users to test their vehicles, followed by regular monitoring and periodic calibration of testing devices. It requires a comprehensive strategy for developing testing labs, including various testing equipment, maintaining emission standards, developing inspection and maintenance programs, developing institutional awareness, and training programs.

[1] https://thehimalayantimes.com/kathmandu/29-per-cent-vehicles-fail-emission-test-in-balkumari/

Department of Transport Management controls and handles all issues related to transport vehicles, including registration, licensing, and emission testing. Since the emission testing constitutes the full range of inspection, testing, and certification task, a separate unit under DOTM that focus mainly on the emissions testing might be necessary to perform the detailed task efficiently. A provincial testing lab will ease the users to perform the test. Regular updating and annual calibration mechanism of the equipment will update the system and improves the overall emission testing system in Nepal. During the discussions with the Director-General of DOTM in September 2019, it was informed that plans are underway for establishing at least one vehicle emission testing laboratory in each Province.

7. Fuel Economy Labelling and Fuel Economy Standard in Nepal

As Nepal is a landlocked country, road transport plays a vital role in the economic development of the country. Motorization density is low compared to other South Asian countries, but the motorization rate, especially in the LDVs segment, is growing at a higher rate of 15% annually in the past decade (DOTM statistics, 2018). Hence, transport fuel economy and reduction of emissions in the transport sector no doubt offer major challenges and opportunities in both the economy and the environment sectors of Nepal.

There is a range of fuel economy policy options available such as fiscal, regulatory, and other fuel economy policy options. There is a substantial impact on improving fuel economy and reducing CO_2 emissions if both the consumer as well as manufacturer – targeted fuel economy policy measures are combined (ASEAN, 2019). There are three categories of policy options – (a) Monetary (Fiscal), (b) Regulatory, and (c) Consumer Information or fuel economy labelling (Figure 1).

Consumer information or fuel economy labelling is essential for consumers in order to decide what type of cars or vehicles they are buying and how much they are emitting CO_2 by driving their vehicles. This information, of course, would help consumers in selecting vehicles having better fuel economy and producing less CO_2 emissions. It is also essential for Nepal because all the petroleum products are imported from India and other countries and less import of them would have a positive impact on the balance of payment situation of the country.

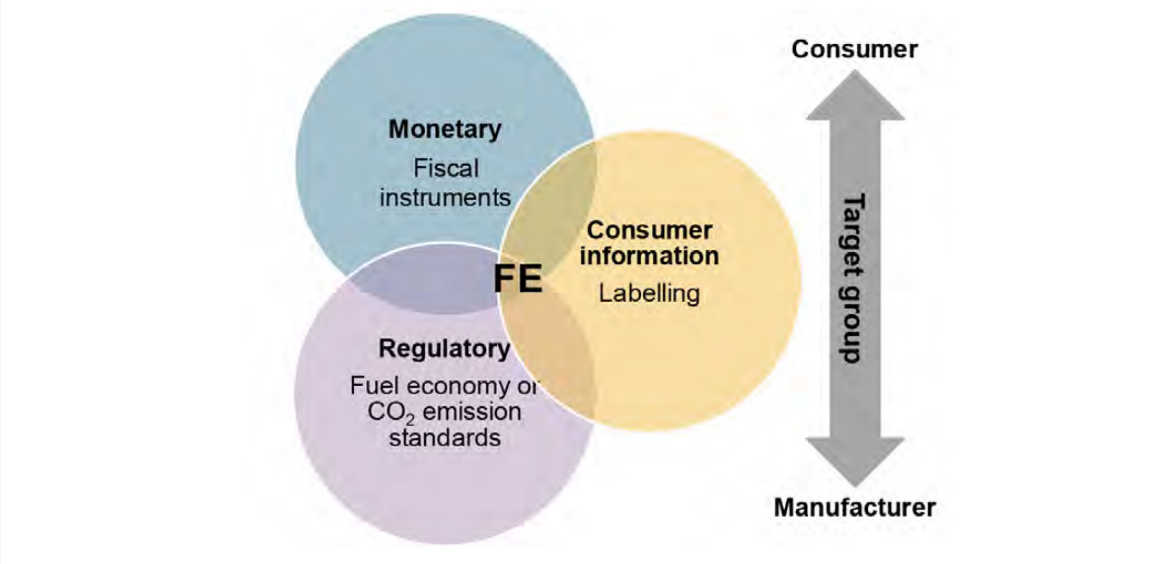

Figure 1. Overview of fuel economy policy measures categories (ASEAN, 2019)

The automotive manufacturing base is almost dormant in Nepal and due to economies of scale, its development can hardly be expected also in the future. Consequently, Nepal must adhere to fuel economy standards or labelling across the border especially India as a major share of LDVs is imported from there.

Nepal can start a star-based fuel economy labelling system initially as in India voluntarily with the addition of CO_2 emission in g/km. The auto-dealers in Nepal usually indicate the fuel economy of the model of the vehicle in their showroom but they hardly give the information on the CO_2 emission rating of the vehicle. Hence, the dealers must be enforced, apart from fuel economy, to show the CO_2 emission in g/km rating as well in the information display of the vehicles in the showroom.

In the second phase, the auto-dealers must be enforced to display the manufacturer's fuel economy and CO2 emission tags in the windshield of the vehicles sold. It helps to compare the manufacturer's information on emissions with the annual emission testing of the vehicles at the offices of the Transport Management, GoN. It might be challenging to implement this kind of scheme initially but the Government must try to implement it if it really wants to control transport emission in the country.

8. Conclusion

The rapid growth of passenger vehicle ownership is one of the main drivers of the increase in fuel consumption, greenhouse gases, and pollutant emissions around the world over the past decades. Fuel economy policies and measures are essential for fuel security and costs, climate change, and air pollution control. With implementations of such policies and measures, there could be up to 16% reductions in fuel and CO_2 emissions if applied to light-duty vehicles (LDVs). The "fuel economy label" refers to information that is displayed about the car in the showroom, online or through other media. The aim of the Vehicle labeling scheme for improved fuel economy is to allow consumers to make a more informed choice when purchasing a vehicle.

A country like Nepal is increasingly dependent on imported fuels, where the fuel prices are volatile, putting pressure on national budgets. Nepal does not manufacture vehicles and imports most of the vehicles from India. Regarding, vehicle fuel economy labeling schemes (VFEL) of Nepal, it needs to follow India's labeling schemes. Since Nepal does not have its VFEL, it has to adopt labelling information/schemes from LDV manufacturers on fuel economy and fuel emission across the border. The baseline fuel economy of Nepal indicated a gradual improvement in fuel economy from 2005 to 2016 at an annual rate of 1.9%. The average liter gasoline-equivalent (Lge) per 100 km was 6.98 in 2005 and improved to 5.81 in 2016. FEPIT analysis shows that at the present improvement rate of -1.89% from 2005-2016 continued, the fuel economy of LDVs will be improved from 5.81 Lge/100 km in 2016 to 4.5 Lge/100km by 2030. However, if the penetration of electric vehicles by 30% by 2030 can be one of the alternative policies, then it shows the improvement of fuel economy to 3.72 Lge/100km by 2030. Besides, if the government imposed a new registration tax of 8% on the vehicle with cc lower than 2000 and 10% of vehicle price on higher cc, then the fuel economy and CO_2 emission in 2030 will improve to 3.28 Lge/100km and 77.78 g/km respectively.

Nepal can start a star-based fuel economy labelling system initially as in India voluntarily with the addition of CO_2 emission in g/km. The auto-dealers can display average CO_2 emission in g/km along with the fuel economy of the vehicle in the showroom. In the second phase, the auto-dealers must be enforced to display the manufacturer's fuel economy and CO_2 emission tags in the windshield of the vehicles sold. This kind of fuel economy labelling would contribute to the enhancement of the fuel economy and in the reduction of CO_2 emission by creating awareness among the consumers.

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