UN environment programme

Fuel Economy and CO_2 Emissions of Light-Duty Vehicles in Egypt

June, 2022

GLOBAL FUEL ECONOMY INITIATIVE
FOR ZERO CARBON VEHICLES BY 2050

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i. List of abbreviations:

MTOE	Million Tons of Oil Equivalent
CO_2	Carbon Dioxide
EE	Energy Efficiency
UNEP	United Nation Environmental Program
LDVs	Light Duty vehicles
NASCO	El Nasr Automotive Manufacturing Company
GOE	Government of Egypt
HDEs	Heavy Duty Equipments
CAPMAS	Central Agency for Public Mobilization and Statistics
GR	Growth Rate
FTA	Free Trade Agreement
EEAA	Egypt-EU Association Agreement
CBE	Central Bank of Egypt
AIDP	Automotive Industry Development Program
GCR	Grater Cairo Region
OVSRP	Old Vehicles Scrapping and Recycling Programme
VSRP	Vehicles Scrapping and Recycling Programme
PPP	Public Private Partnership
MoF	Ministry of Finance
CDMAP	Clean Development Mechanism Awareness and Promotion Unit
CNG	Compressed Natural Gas
LPG	Liquefied Petroleum Gas
MoP	Ministry of Petroleum
NGVS	Natural Gas Vehicles
UNEP	United Nations Environmental Programme
CBU	Completely Built Unit (imported)
CKD	Completely Knocked Down Unit (locally assembled)
DCs	Driving Cycles
NEDC	New European Driving Cycle
GEFI	Global Fuel Economv Initiative
ICCT	International Council on Clean Transportation
SUV	Sport Utility Vehicle
GHGs	Greenhouse Gases
CEDARE	Center for Environment and Development in the Arab Region and Europe
ERSAP	Economic Reform and Structural Adjustment Program
OEMs	Original Equipment Manufacturers

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1. Introduction & Background

Executive Summary

The transport sector is regarded as one of the main drivers for social and economic development but also a major energy consumer and emission source. LDVs represent more than 49% of the total licensed vehicles in Egypt, and accordingly, improving the Fuel Economy (FE) of LDVs in Egypt has become on the top of the list of recommended policies to reduce transport sector energy consumption and pollutant emissions. This report presents the results of defining the the average FE of LDVs in Egypt during the years (2017 to 2021), and to offer that as an update to data developed in previous studies covering years since 2005. This baseline and trendline assessment is presented, followed by recommendations for policies and measures to approach the global goals of the Global Fuel Economy Initiative (GFEI). The current study highlights several main conclusions, of which the following are the most important:

1. Total car sales (imported and locally assembled) has increased from 205,500 in 2009 to 277,800 cars in 2021, with an average annual growth rate of 2.5% during that period.
2. The average FE of LDVs passenger cars in Egypt had previously hovered below 81/100km in 2005, reaching 71/100km in 2015. In the present update, results revealed a further decline that has reached 61/100km, showing a rapid improvement during the 5 years period of 2017-2021.
3. Electric cars have not yet penetrated the market at a rate that would be of significance to FE indicators, but are expected in the long term to gradually contribute to FE improvement. Most improvement will however be expected to come from the actual improvement of ICE vehicles efficiency, as a continuation of the observed promising trends, and improved efficiency attributed to OEMs efficiency improvement along with the inclination toward lower cost smaller engine-size vehicles (strongly correlated with FE).

To achieve the GFEI's target of 4 L/ 100 Km by 2030 as well as guaranteeing the growth of the automotive market and industry in Egypt, a set of effective FE recommended policies are recommended:

(1) Implementation of mandatory FE standards and labeling,
(2) Continuation of implementing the recently developed vehicles scrapping programme for LDVs and extending it to cover other vehicles segments (e.g. microbuses, buses, etc.) in the future,
(3) Creation of Low-Emission Zones (LEZs) in some cities in Egypt, where vehicles of higher FE than the specified level are subject to higher entrance fees,
(4) Provision of attractive and effective economic incentives/ disincentives (e.g. feebate schemes, tax exemptions or reduction for cleaner cars, fuel taxation or CO_2 taxation, special exemptions for advanced technologies, etc.),
(5) Implementation of regular inspection and maintenance programmes for cars to ensure their compliance with the FE standards,
(6) Awareness and information dissemination (e.g. awareness about efficiency and labeling, reporting, etc.),
(7) Establishment of an FE Information Management System (FEIMS), either standalone or as a part of relevant entities databases and information systems,
(8) Empowering the role of the GOE in the planning and expansion of the automotive industry in Egypt, including providing strong political support for local manufacturers and continuing the dialogue with key industry players to develop an automotive policy,
(9) Development of a comprehensive, well-considered e-mobility strategy to accelerate FE improvement over the long run.

1. Introduction and Background

The transport sector is regarded as one of the main drivers for achieving social and economic development in Egypt. At the same time, it is also considered among the major energy consuming sectors and sources of pollutants emissions. In year 2020/2021, the transport sector total oil products and natural gas consumption was estimated at about 13.3 MTOE, representing around 16% and 27% of Egypt's total and final oil products and natural gas consumption during the same year respectively. Accordingly, CO_2 emissions from the transport sector, estimated at about 24 million tons, represent more than 15% and 26% of Egypt's CO_2 emissions from the total and final oil products and natural gas consumption during the same year respectively. As part of the continuous efforts to increase Energy Efficiency (EE) in different sectors in Egypt -including transport- and minimize GHGs and pollutants emissions, the international not-for-profit organization Centre for Environment and Development in the Arab Region and Europe (CEDARE) in cooperation with the United Nations Environment Programme (UNEP) and with the assistance of UNHABITAT are preparing the current brief study on "Fuel Economy and CO_2 Emissions of Light-Duty Vehicles in Egypt". The study aims to assess and define the appropriate and effective policies and measures necessary for curbing greenhouse gases and pollutant emissions from the Light-Duty vehicles (LDVs) -as the most important segment of transport sector in Egypt- as well as recommend policies to accelerate the improvement of vehicle choices in the market.

2. Baseline Assessment

2. Baseline Assessment

The baseline assessment of LDVs market is perceived as the main block and the most important step for developing an effective and efficient policy for transport fuels usage and recommending the appropriate policy measures to achieve that objective. The assessment covers the following main areas: Automotive market main indicators, history of automotive industry in Egypt, existing automotive manufactures companies, licensed vehicles in service (2011-2020) in total and by type, vehicles distribution by age in 2020 (passenger cars – private cars and taxi), motor vehicles production (2009-2020), LDVs imports- passenger and other vehicles (2005-2016), LDVs exports- passenger and other vehicles (2006-2017), LDVs annual sales (2009-2020), existing laws and regulations, and previously implemented policies and measures to improve the energy sector utilization efficiency and reduce CO_2 emissions.

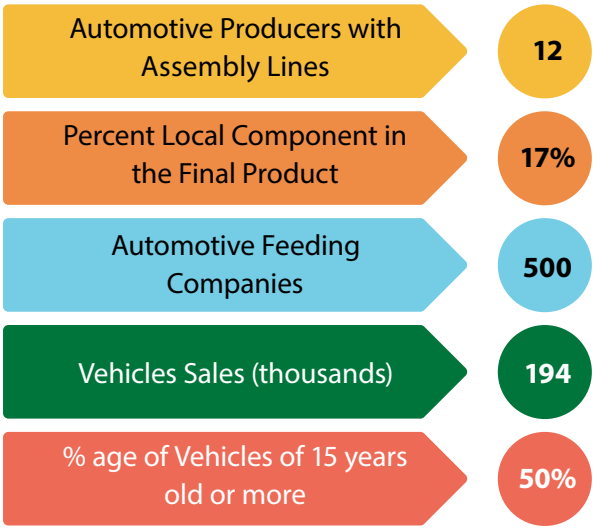


Figure (2.1) automotive market main indicators in 2019

2.1. Automotive Market Main Indicators [1]

Figure (2.1) presents the main indicators of the automotive market in Egypt in year 2019.

2.2. History of Automotive Industry in Egypt [1] - [4]

The automotive industry in Egypt has a long history that extends over more than six decades, since 1959, when the Egyptian government signed a contract with a German firm for the local manufacturing of trucks and buses, in addition to the creation of a new Egyptian company responsible for assembling the vehicles as well as manufacturing around 50% of its components. Since late 1950s, the industry has witnessed several stages of success and failure. The following is a brief of the history and the development path of the Egyptian automotive industry since then.

The 1960s

The real start of Egypt's automotive industry begins with the establishment of El-Nasr Automotive Manufacturing Company (NAMCO) in 1961 in Helwan, south of Cairo. The company -through agreements with several European automotive companies- started the production of tractors (with Yugoslavia's IMR), trucks (with Germany's BLUMHARDT) and passenger cars (with Italy's FIAT). During the decade of its establishment, the company stated that its average annual production of trucks and buses was estimated at 3000 trucks and 1600 buses, with 70% total content. Within the same period, the 1960s, the highest average annual production rate of passenger cars was valued at 21000, with 30% local content. The 1967 war and its following economic challenges had a negative impact on the company budget and consequently production and performance. By the year 1974, a major downturn occurred to the company because of the adopted policies by the Government of Egypt (GOE), ending the previous ban on cars importation in addition to directing the company to focus its passenger car assembly on one model (the FIAT/ Nasr 128). In 1994, the GOE put NAMCO for sale under its implemented privatization program by that time.

The 1970s (the Open-Door Policies Era)

During that period and after the 1973 war, the GOE started a new policy which relied mainly on diverting its attention from the public sector towards attracting foreign and private investments. As a result, NAMCO as a public state-owned company continued its operation with almost obsolete machinery, and lines of production, and surplus labor. Moreover, no funds were injected to revamp the production lines or to enhance research and development. In an attempt to improve that situation and enhance the company productivity, introduce or bring in new efficient technologies and attract foreign and private investments, the management of the company proposed several approaches, of which none -unfortunately- succeeded, due to political interference in the decision-making process.

During the 1980s and the 1990s

As a result of the open-door policy during the 1970s, the GOE encouragement of the private sector and its intention to attract foreign investment, several foreign companies entered the market of the automotive industry in Egypt during the 1980s. Meanwhile, with the flow of foreign capital and the continued protection of the automotive industry, El-Nasr Company (NAMCO) continued to be a key player in the automotive industry in Egypt through assembling vehicles under several acquired licenses from different international brands, such as Chrysler, KIA, Peugeot, etc. With the start of the 1990s, the GOE adopted the Economic Reform and Structural Adjustment Program (ERSAP) and restricted investment in the public sector; more foreign companies entered the automotive market and established assembly lines and factories. Examples of these companies included Citroen, Fiat, Hyundai, Mercedes- Benz, Nissan, BMW, Toyota, etc. However, and considering the small size of the market, the existing price distortion and over protection of the industry, most of these companies worked with only 30% of their capacities. By the end of the 1990s, NAMCO was divided into four companies in 2000, to restructure their debit and sell them to the private sector.

The Period 2000 Till Now

During the period from 2000 till 2010, the automotive industry in Egypt and its feeder industries (parts, service, repair, financial services, etc.) witnessed a rapid growth, as the number of locally produced and assembled cars increased to reach its peak by the end of 2010, with around 117000 cars. However, starting 2011 and till 2020, the total number of cars production in Egypt started to decline, reaching its minimum level of 18500 vehicles in both 2018 and 2019, after which it started to increase in 2020, as shown in figure (2.2). The political and economic instability following the 25th of January 2011 revolution is perceived as one of the main reasons for that situation, as a number of automotive operating companies suspended their production activities, such as Nissan, Toyota, Hyundai, BMW, Daimler, General Motors, etc. Other factors and challenges included the depreciation of the Egyptian pound by 44% in 2004 raising the cost of both imported and locally assembled cars using imported components, the relatively small market and the limited purchasing power, particularly after the 25th of January 2011 when vehicles production levels started to drop by about 30% (around 82,000 in 2011) and so on. During the years 2018 and 2019, because of the political and economic recovery and improvements, several OEMs announced their return and

intention to expand their existence and activities in Egypt's automotive market. The tendency of GOE to resolve their disputes with the international automotive companies was also among the supporting factors. As an example, in June 2019 two pending disputes with Mercedes-Benz and BMW were resolved.

Currently, there are 83 car-manufactures in Egypt, including giant world automotive manufacturers as GM, BMW, Hyundai, Toyota and Nissan, who have their main product line in Egypt's factories. Additionally, there are more than 15 car-assembly factories and 75 facilities that provide over 75,000 job opportunities and have an annual production capacity of 300,000 passenger cars, light commercial vehicles, trucks and buses. On the other side, Egypt's car ownership rate is considered relatively small compared to other countries.

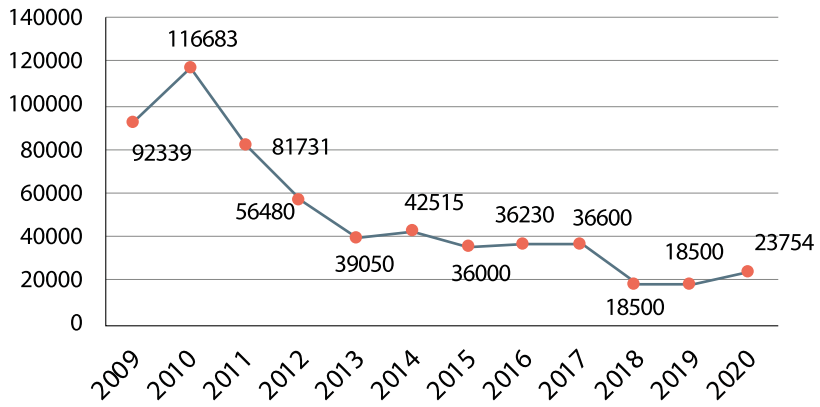


Figure (2.2) Egypt Motor Vehicles Production (2009-2020)

2.3. Existing Automotive Manufacturers Companies [4] [5]

As previously mentioned, there are currently 83 car-manufactures in Egypt, including giant world automotive manufacturers, such as GM, BMW, Hyundai, Toyota and Nissan who have their main product line in Egypt's factories. The following are examples of them:

1. Al Fotouh Car Assembly Company
2. **Arab American Vehicles:** a joint venture between the Arab Organization for Industrialization (51%) and the Chrysler Group LLC (49%), producing military and civilian vehicles (assembler of the Jeep Cherokee and JeepWrangler).
3. **El-Tramco:** assembler of the Polish and Czech vehicles: Rama and Jawa.
4. **General Motors Egypt S.A.E.:** a joint venture between world leader General Motors International, and the local importer and car dealer Al-Mansour Automotive Company. The company factory is located in the 6th of October City, assembling Opel Vectra, Chevrolet and Isuzu trucks, as well as the Frontera 4x4 vehicles.
5. **Ghabbour Group:** the largest car-manufacturer in Egypt, founded in 1940 and produces 150,000 units annually. The company manufactures cars for Bajaj Auto, Hyundai and Volvo.
6. **JAC Motor:** a state-owned car manufacturer (assembler of Citroen). The company was founded in 1964 and was listed on the Shanghai Stock Exchange in 2001.
7. **Mercedes Egypt:** established as a wholly owned subsidiary of Daimler AG in December 1999.[13] An assembler for the Mercedes Benz vehicles.
8. **Suzuki Egypt:** assembler of Suzuki passenger vehicles (The Suzuki 800)
9. **Wagih Abaza Company:** assembler of the Peugeot 405.
10. **The Bavarian Auto Group:** an Egyptian enterprise for manufacturing and selling BMW vehicles on the local market. The company was founded by BMW in March 2003 and is located in the 6th of October City.

11. Speranza Motors, Ltd.: an Egyptian automotive manufacturer based in Maadi, Cairo. It is part of the Daewoo Motor Egypt (DME), which itself belongs to Aboul Fotouh Group. The factory is located in the 6th of October City.
12. The Seoudi Group: an Egyptian automobile manufacturer, founded in 1975 with its current head office in Cairo.The company began its work with the Modern Motors S.A.E., a manufacturer of Nissan vehicles.
13. Egyptian German Automotive Company: an Egyptian car assembler, founded by former Daimler-Benz CEO and Samy Saad as a joint venture to assemble vehicles of the Mercedes-Benz brand. It is located in the 6th of October City assembling Mercedes Benz vehicles.
14. El Nasr Automotive Manufacturing Company: previously the first Arab vehicle manufacturer and state-owned.[2] The company mainly produced the Fiat-based vehicle, because of the engineering and design issues. The company also assembled foreign licensed cars under its brand.
15. MCV Bus and Coach: a bus-bodies manufacturer, founded in 2002.
16. Egy-Tech Engineering: a three-wheeled vehicles manufacturer.
17. Manufacturing Commercial Vehicles: an Egyptian company manufacturing buses and trucks. The factory is located in Salheya.
18. Gorika Egypt: assembler of trucks.
19. Lada Egypt, etc.

2.4. Licensed Vehicles in Service (2011-2020), Total and By Type

As shown from tables (2.1-2.2) and figures (2.3-2.4):

- Total number of licensed vehicles in Egypt increased from about 6.3 million in 2011 to about 10.8 million in 2020, with an average annual growth rate of 6.2% during that period. LDVs passenger cars represented 49.4% of the total number of licensed vehicles in 2020 compared to 1.7% for buses, 12.7% for trucks and lorries, and 36.1% for other types of vehicles which include motorcycles, tractors, Heavy Duty Equipment (HDEs) and Tuk-Tuks.
- Total number of Light Duty Vehicles (LDVs) has increased by about 1.4 fold or 45% during the last decade (2011-2020), from about 3.7 in 2011 to 5.3 million vehicles in 2020, with an average annual growth rate of 4.2% during that period.
- LDVs represented the largest share out of the total number of licensed vehicles in Egypt, with shares estimated at 58.3% and 49.4% during the years of 2011 and 2020 respectively.

Table (2.1) Licensed Vehicles in Service (2011-2020)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	**6321336**	**6552255**	**6985377**	**7784560**	**8548748**	**9250694**	**9764127**	**10695694**	**11267271**	**10801239**
Private car	3095174	3231513	3470426	3737984	4057558	4299884	4712562	4952734	5238260	4817176
Taxi	361279	307166	318727	322095	324445	373482	383423	376456	377429	370461
Caravan	1056	947	992	1015	2401	1027	1159	1078	1191	1318
Custom plate	67397	32741	26963	29268	34794	35017	1258	52965	70565	8899
Diplomatic	6365	6453	6443	7165	7546	7743	22656	7848	7865	5400
Tempory & Commercial	12277	12112	10717	10850	10826	10877	690	10856	11381	267
Bury's car	1968	2348	2143	2236	2335	2446	2807	2614	2738	3353
Government	64620	61551	52649	52966	53944	56856	59085	56208	56818	57630
Public Sector	32067	29865	23320	23291	23620	23726	26078	23195	23411	26079
Governorate	42960	43157	41671	42446	43005	43747	40207	45641	46788	41661
Public buses	19134	19417	16434	16584	16918	17806	16065	15321	15867	16567
Private buses	36352	31556	36979	40306	45546	49980	62563	58278	61533	78297
Tourism buses	16756	17321	18640	18963	19533	18805	23549	19479	20911	23628
Travels buses	26435	27518	39459	43175	43494	43240	40219	43700	46916	49723
School buses	10947	11300	11141	11537	11998	12937	13392	13794	14349	15030
Lorry	906729	942821	985518	1045509	1135852	1209504	1258639	1386853	1460428	1286653
Truck	75012	77557	68657	71193	76131	92996	92488	100713	104949	99404
Motorcycles	1525556	1674812	1837605	2290776	2621171	2933507	2994519	3511419	3689678	3605884
Tractor & others *	19252	22100	16893	17201	17631	17114	12768	16542	16194	293809

* Include heavy equipmemt and Tuk Tuk (2158 & 274984 respectively) in 2020.
Source: CAPMAS.

Table (2.2) Licensed Vehicles in Service (2011-2020)

	2011	2020	Share Percentage 2011	Share Percentage 2020	Change	Change Percentage	Average Annual GR Percentage
LDVs	3685163	5332244	58.3%	49.4%	1.4	44.7%	4.2%
Buses	109624	183245	1.7%	1.7%	1.7	67.2%	5.9%
Lorries & Trucks	981741	1386057	15.5%	12.8%	1.4	41.2%	3.9%
Others	1544808	3899693	24.4%	36.1%	2.5	152.4%	10.8%
Total	6321336	10801239	100.0%	100.0%	1.7	70.9%	6.1%

Others include motorcycles, tractors, HDEs in addition to Tuk-Tuks in 2020 only.

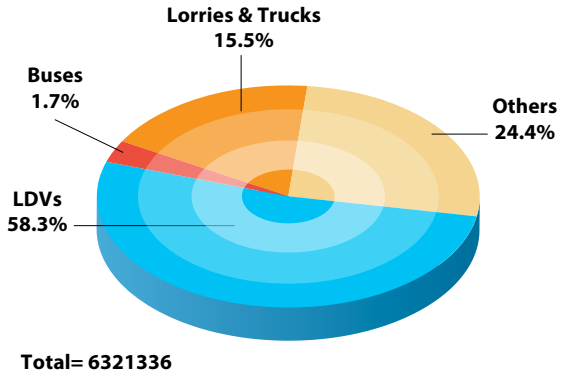


Figure (2.3) Licensed Vehicles By Type (End of 2011)

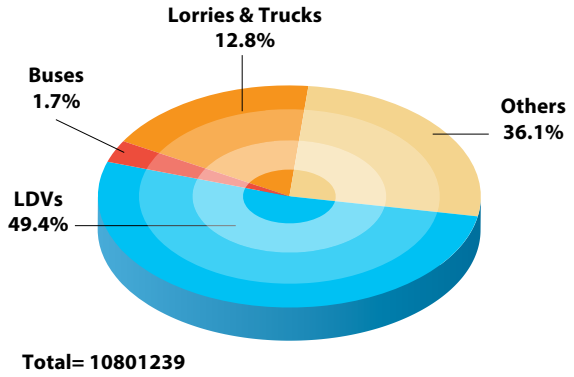


Figure (2.4) Licensed Vehicles By Type (End of 2020)

2.4.1. Total Licensed LDVs Distribution by License Type

As shown from table (2.3) and figure (2.5), private cars represented the largest share of licensed LDVs in Egypt in 2020, with 92.6% compared to 7.1% for taxi vehicles, while the rest of LDVs types represented only 0.3%.

Table (2.3) Total Licensed LDVs Distribution According to License Type (2020)

Type	Private	Taxi	Caravan	Temporary	Customs	Diplomatic	Total
Number	4817176	370461	1318	267	8899	5400	5203521
Percentage %	92.6%	7.1%	0.0%	0.0%	0.2%	0.1%	100.0%

Source: CAPMAS.

Excludes service cars (Burial, Government, Public Sector and Governorate cars or vehicles accounted for 3353, 57630, 26076, and 41661 vehicles respectively in 2020.

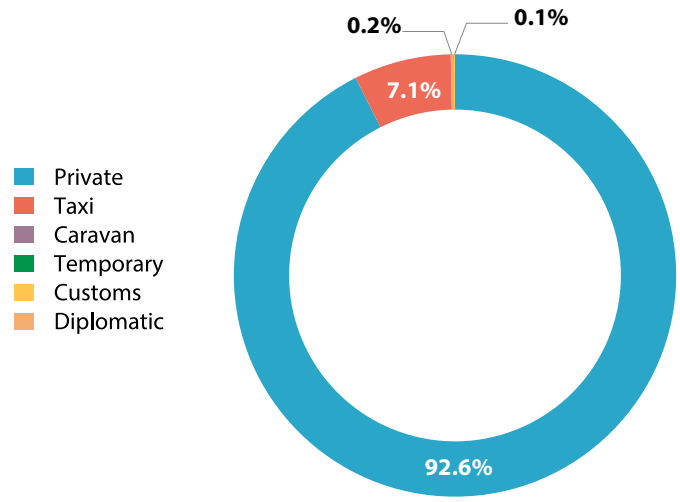


Figure (2.5) Total Licensed LDVs Distribution According to Type (2020)

2.4.2. Total Licensed LDVs Distribution By Fuel Type (2020)

As shown in table (2.4) and figure (2.6), the number of LDVs using gasoline as a fuel represented 94.6% of the total licensed LDVs in 2020 compared to 3.6% for cars utilizing diesel, 1.8% for hybrid cars utilizing both gasoline and natural gas, 0.003% for Electric Vehicles (EVs) and 0.001% for hybrid cars utilizing both gasoline and electricity.
As shown from table (2.3) and figure (2.5), private cars represented the largest share of licensed LDVs in Egypt in 2020, with 92.6% compared to 7.1% for taxi vehicles, while the rest of LDVs types represented only 0.3%.

Table (2.4) Total Licensed LDVs Distribution According to Fuel Type (2020)

Fuel	Gasoline	Gasoline/ Natural Gas	Gasoline/ Electricity	Electricity	Diesel	Total
Number of Vehicles	4,922,201	94,877	31	159	188,287	5,205,555
Percentage %	94.6%	1.8%	0.001%	0.003%	3.6%	100.0%

Source: CAPMAS.
Excludes service cars (Burial, Government, Public Sector and Governorate cars or vehicles accounted for 3353, 57630, 26076, and 41661 vehicles respectively in 2020.

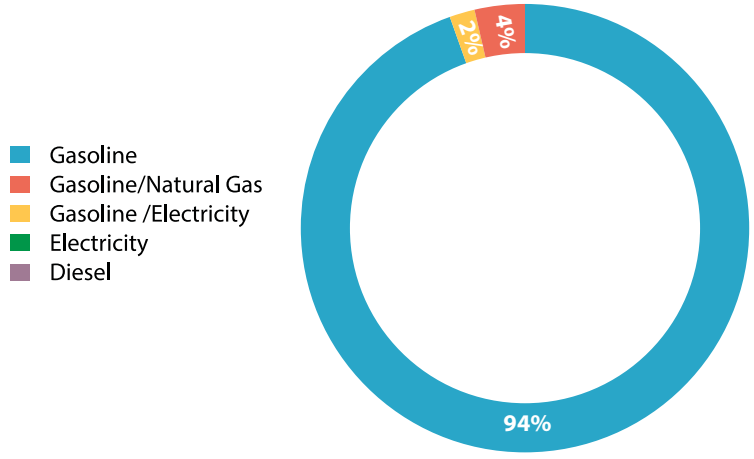


Figure (2.6) Total Licensed LDVs Distribution According to Fuel Type (2020).

2.5. Vehicles Distribution By Age 2020 (Passenger Cars – Private Cars and Taxi)

As shown from table (2.5) and figure (2.7):

- Private cars of more than 20 years old were estimated at around 1.4 million, representing 29% of the total number of private cars (around 4.8 million) in 2020.
- At the same time, private cars with less than 20 years old were estimated at around 3.4 million, representing around 71% of the total number of existing private cars in Egypt during the same year.
- Taxis and microbuses of more than 20 years old were estimated at around 150,000 vehicles, representing almost 27% of the total number of taxis and microbuses (around 554,000) in 2020.
- Meanwhile, taxis and microbuses with less than 20 years old estimated at around 404,000, representing around 73% of the total number of existing taxis and microbuses in Egypt during the same year.

Table (2.5) LDVs (Private Cars and Taxis) and Microbuses Distribution By Age in Egypt (2020)

	> 20 years	< 20 years	Total
Private Cars	1,400,000	3,417,176	4,817,176
Taxis and Microbuses	150,000	403,706	553,706

Source: Ministry of Finance.

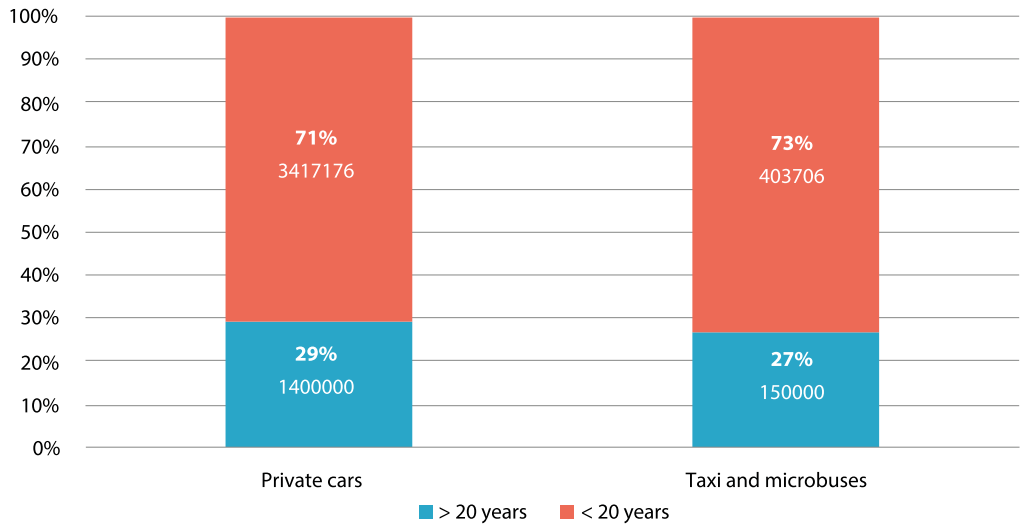


Figure (2.7) LDVs (Private Cars and Taxis) and Microbuses Distribution By Age in Egypt (2020)

2.6. Motor Vehicles Production (2009-2020)

As shown from table (2.6), cars production in Egypt decreased over the last decade from around 92,300 in 2009 to 23,800 in 2020, with an annual decline rate of 11.6% during that period.

Table (2.6) Total Licensed LDVs Distribution According to Fuel Type (2020)

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Average Annual GR % (2009 - 2020)
Number	92339	116683	81731	56480	39050	42515	36000	36230	36600	18500	18500	23754	-11.6%

Source: International Organization of Motor Vehicle Manufacturers https://www.ceicdata.com/

2.7. Motor Vehicles Imports- Passenger and Other Vehicles (2005-2016)

During the period (2005-2017), Egypt's total motor vehicles imports (both passengers and other motor vehicles) increased from around 4,300 vehicles in 2005 to around 42,300 in 2016, with an average annual growth rate of 23.1% during that period. At the same period, passenger vehicles imports increased from around 2,100 in 2005 to more than 25,400 in 2016, with an average annual growth rate of 25.5%. Other motor vehicles imports also rose from around 2,200 in 2005 to around 17,000 in 2016, with an average annual growth rate of 20.3%, as demonstrated in table (2.7). The share of both passenger and other vehicles out of the total motor vehicles imports in 2016 accounted for 60% and 40% respectively. The corresponding shares of the total motor vehicles imports in Egypt in 2005 are 49% and 51% respectively (see figure 2.9).

Table (2.7) Motor Vehicles Imports- Passenger and Other Vehicles (2005-2016)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Avg. Annual GR %
Passenger Motor Vehicles	2,097	4,919	6,357	7,896	7,580	7,656	7,573	7,316	9,098	7,408	16,794	25,407	**25.5%**
Other Motor Vehicles	2,215	4,198	4,976	6,328	6,555	6,387	9,055	7,047	8,480	7,083	9,991	16,922	**20.3%**
Total	4,312	9,117	11,333	14,224	14,135	14,043	16,628	14,363	17,578	14,491	26,785	42,329	**23.1%**

Source: Https://www.ceicdata.com/

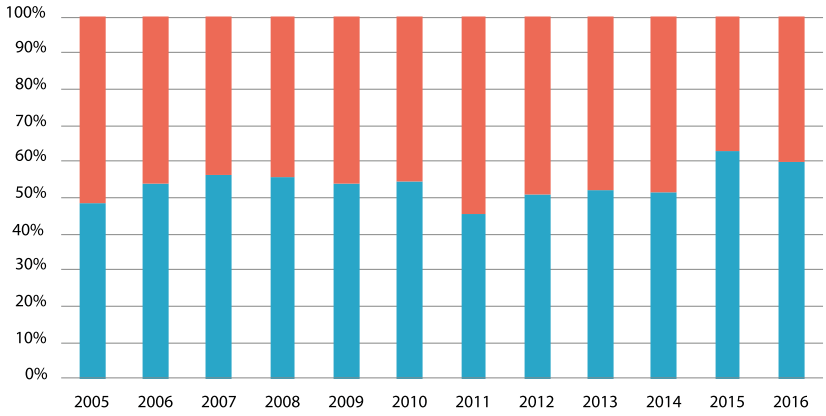


Figure (2.8) Motor vehicles imports- passenger and other vehicles (2006-2016)

2.8. Motor Vehicles (Passenger and Other Vehicles) Exports (2006-2017)

During the period (2006-2017), Egypt's total motor vehicles exports increased from around 500 vehicles in 2006 to around 6,600 in 2017, with an average annual growth rate of around 26% during that period. Within the same timespan, passenger vehicles exports increased from only 40 vehicles in 2006 to 90 vehicles in 2017, with an average annual growth rate of 7.7%. Other motor vehicles exports also increased from 488 in 2006 to around 6,548 in 2017, with an average annual growth rate of 26.6% (refer to table 2.8). The share of both passenger and other vehicles of the total motor vehicles exports in 2017 accounted for 1% and 99% respectively. The corresponding shares of total motor vehicles imports in Egypt in 2006 were 10% and 90% respectively (check figure 2.9).

Table (2.8) Motor Vehicles Imports- Passenger and Other Vehicles (2006-2017)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Avg. Annual GR %
Passenger Vehicles	40	21	42	26	36	188	250	415	346	806	75	90	**7.7%**
Other Vehicles	488	183	49	227	1328	152	1500	975	956	813	4132	6548	**26.6%**
Total	528	204	91	253	1364	340	1750	1390	1302	1619	4207	6638	**25.9%**

Source: Https://www.ceicdata.com/

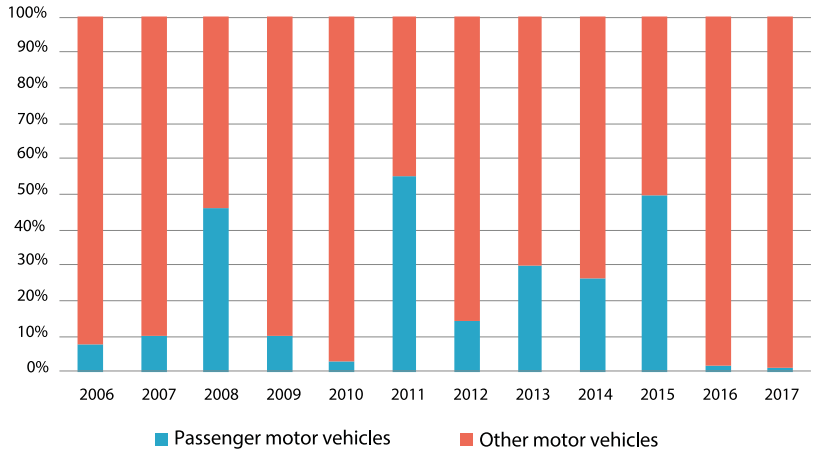


Figure (2.9) Motor Vehicles Exports

2.9. Cars Annual Sales (2009-2021)

Total motor vehicles sales (both imported and locally assembled) increased from 205,500 in 2009 to 277,800 vehicles in 2021, with an average annual growth rate of around 2.5% during that period (see table 2.9 and figure 2.10). The years 2014 and 2015 achieved the largest car sales with around 34,900 and 33,200 vehicles respectively.

Table (2.9) Motor Vehicles Annual Sales (2009-2021)

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Sales	205,521	248,917	271,900	286,300	283,000	349,100	332,100	264,100	126,941	184,456	170,568	219,732	277,805

Source: International Organization of Motor Vehicles Manufacturers Https://www.ceicdata.com/

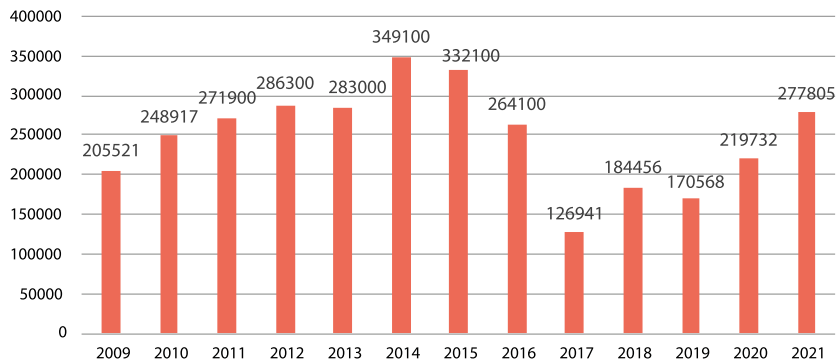


Figure (2.10) Motor Vehicles Total Annual Sales (2009-2020)

LDVs (Passengers Cars) Sales Ranking by Brand

In 2021 and as shown from table (2.10), Hyundai topped the passenger cars sales list of the Egyptian automotive market with a share of 14.5%, in addition to holding the same position in 2017. MG came in the second rank followed by Nissan in the third rank (compared to the third rank in 2017), then Toyota, Kia and Sherry in the fourth, fifth and sixth ranks respectively (as that in 2017). After that, Suzuki ranked seventh place, Peugeot in eighth place, Fiat in nineth place, and finally Chevrolet in tenth place compared third in year 2017.

Table (2.10) LDVs (Passengers Cars) Sales Ranking by Brand

Brand	2017 Sales	2021 Sales	2017 Sales Share	2021 Sales Share	2021 Ranking
Hyundai	21821	24850	1	1	14.5%
MG	0	23600	7	2	13.7%
Nissan	20208	22374	2	3	13%
Toyota	7590	18594	4	4	10.8%
Kia	5746	16478	5	5	9.6%
Sherry	5477	16314	6	6	9.5%
Suzuki	0	15629	8	7	9.1%
Peugeot	0	12755	9	8	7.4%
Fiat	0	12705	10	9	7.4%
Chevrolet	8649	8392	3	10	4.9%
Total	69491	171691			100%

Source: AMIC.

LDVs (Passengers Cars) Sales Ranking According to Origin

In year 2021 and as illustrated in table (2.11), LDVs passenger cars with Japanese origins ranked as number one in LDVs (passenger cars) sales within the Egyptian automotive market with a market share of 28%, keeping its position the same as in 2017. Vehicles of Chinese origins came in second rank in 2021 with a market share of 24% (compared to fifth in 2017), followed by European vehicles in third rank (as in 2017) with a market share of 23% in 2021. Then, South Korean vehicles came in the fourth rank with a market share of 19% (stepping down from second rank in 2017), and finally vehicles of USA origins ranked number 5 (moving one step up from its rank in 2017 which was number 4).

Table (2.11) LDVs (Passengers cars) sales ranking according to origin

Year	2017 Sales	2021 Sales	2017 Sales Share	2021 Sales Share	2017 Ranking	2021 Ranking
Japan	34875	60229	28%	28%	1	1
China	8488	51463	24%	24%	5	2
Europe	16277	50212	23%	23%	3	3
South Korea	27657	41328	19%	19%	2	4
USA	12323	11838	6%	6%	4	5
Total	99620	215070	100%	100%		

Source: AMIC.

2.10. Automotive Feeding Industry [1]

The automobile feeding industry of Egypt started in 1980s by General Motors Egypt. In 2006 and 2007, the automotive feeding industry bloomed, impacted by Egypt's positive economic outlook and the high level of customs and duties, encouraging investors to come to Egypt. This in turn encouraged OEMs -such as Jeep, BMW and Mercedes-Benz- to assemble cars in Egypt despite being obliged by law to secure at least 40% of the parts from domestic suppliers, which could not be fulfilled. The domestic content mandate was later increased to 45%. There are currently 500 automobile feeding companies in Egypt, serving 16 assembly plants. They mainly produce exhaust components, air conditioning units, radiators, plastics for interiors, windshields, mirrors and seats, supplying international brands assembling their models locally or selling manufacturer-approved spare parts. However, the local components market is limited with only 80 auto feeders directly supplying local assembly plants. Moreover, the auto feeding industry is considered as an important source of foreign currency for Egypt's economy. Around 60 auto feeders export their products to foreign markets, although 480 auto feeders are registered to do so. Auto feeders are the second biggest exporter in the engineering industries category, accounting for 27% of engineering exports in 2017. The main market for automotive feeders is Europe (80% of all Egyptian auto parts are exported). Arab countries account for 18% and the rest goes to Asia. Total investment in automotive industry in 2019 estimated at USD 3 billion; USD 1.6 billion in the automotive industry and USD 1.4 billion in the feeding industries.

2.11. Existing laws and regulations

The Traffic Law [6]

Article (2/4) of the Traffic Law promulgated by Law No. 66 of 1973, and amended by Law No. 121 of 2008, stipulates that *"it is not permissible to continue licensing taxis and passenger-transport cars that have been manufactured for twenty years".*

Traffic law 121/2008 [7]

In 2008, the Ministry of Interior enacted traffic law no. 121 of 2008, which stipulates that *"all passenger-transport vehicles (taxis, buses and microbuses) exceeding 20 years old cannot renew their license to operate, effective as of August 1, 2008"*. The law acted as an incentive to accelerate vehicle replacement and improve air quality, and came at a time when the automotive industry needed stimulation during the economic crisis. The law however did not mention how the old vehicles will be handled, such as through proper scrapping and recycling to ensure that the old inefficient technology is not reused elsewhere (UNFCCC, 2009). A taxi replacement scheme was therefore implemented to manage the replacement of old taxis in the form of a vehicle scrapping and recycling program. Other schemes for other vehicle types are yet to be introduced.

Customs and taxation

In 1993, a commercial ban on imports of passenger cars was lifted and replaced with import duties so that the local industry then faces controlled competition. In 1998, multiple decrees were issued to regulate vehicle importation, including the stipulation that all imported cars must be of the same year of production and brand new. Tariff rates imposed on imported passenger cars (CBUs) vary according to engine size. In 2014, the tariffs currently range from 40% for passenger cars of capacity up to 1600 cc, to 135% for those above 1600 cc (Ministry of Finance, 2014). Sales taxes also follow similar logic where cars of engine sizes up to 1600 cc are subject to 15% sales taxes, while those above 1600 cc are subject to 30% sales taxes, or 45% if they are imported (CBUs) (AMCHAM 2010). Passenger cars with large engine sizes are seen as luxury goods and hence the higher tariff rate and sales taxes.

International trade agreements [8]

International trade agreements are in place in Egypt, gradually eliminating tariffs through various schemes. Agreements include the Egypt-EU Association Agreement (EEAA), Egypt-Turkey Free Trade Agreement (FTA), and the Egypt-European Free Trade Association (EFTA) (AMCHAM, 2010). The implied competition of these agreements

is expected to incentivize local manufacturing to reach and maintain international standards in locally-produced cars in order to survive. Such upgrade in standards due to facilitated imports or improved local manufacturing may improve the performance of new vehicles in Egypt. However, there has not been any study to monitor such impact on fuel economy and emissions. With regards to interventions for promotion of cleaner vehicles, there are no incentives or disincentives to date explicitly attributed to fuel economy of cars or emission rates except for ad-hoc projects or pilot projects. The most significant program of such is the Taxi replacement program, which was accompanied by a decree that terminates the license renewal of any mass transport vehicle (including taxis) that exceed 20 years of age.

Egypt-EU Association Agreement[1]

The final phase of the EU-Egypt Association Agreement (entered into force in 2004), that led to the gradual reduction of customs duties on imported European cars, was completed on January 1st, 2019, resulting in duties on imported cars from Europe falling to 0%. According to the agreement, customs duties on cars with engines of 1,300 CC capacity imported from Europe were eliminated in 2016. For cars with engines of 1,600 CC and above, reductions took place annually at a rate of 4% annually until they reached 0% in 2019. Imported cars are still subjected to a VAT at 14%, a 0.5% industrial and commercial profit tax, a 3% resources development fee, and a 1% additional tax. Following the tariff elimination in 2019, the market prices of cars of European origin have since gone down (ranging between 2.6% and 31.1%). Prices for non-luxury passenger vehicles from the EU dropped between EGP 20,000 and EGP 40,000. Luxury car prices also drop by about EGP 100,000 to EGP 150,000.

On the other hand, local non-EU vehicles assemblers, which are subjected to various custom duties (on local components), continue to complain of challenges faced in competing with customs-exempt European vehicles. Non-European auto parts are subjected to around 5% to 7% custom duties, 3% to 8.5% development fees. Still, the tariff removal is unlikely to have a broader effect on market prices, as more than 65% of cars sold in Egypt have either a 1.6-litre engine or smaller.

Advent of auto credit facilities[6]

A significant influence on car sales in the past years has been the rapid advent of various credit facilities and the spread of the culture of car loans. In 2007-2008 alone, new car purchases using consumer credit grew from 40% to 60%. This new market growth may be partially attributed to the improved performance of the banking system during its period of reform leading to the development of new and diverse services. Other than banks, auto credit providers also offer similar facilities. Car dealers and manufacturers may as well offer loan financing programs. The various schemes and models offered allow a larger segment of consumers to purchase cars. Standards related to environmental performance of vehicles however have not been mainstreamed into any of the schemes. The formation of a committee for controlling passenger's cars prices.

In August 2019, one month after the launch of "Let it Rust" initiative which aimed at curbing passenger's vehicles price rise, the Egyptian Prime Minister issued a decision to form a committee with the main mandate to monitor the auto market and control the random increase in passenger imported cars prices, including customs and other fees, and with the ultimate goal of rebuilding consumer trust in automotive suppliers.[1]

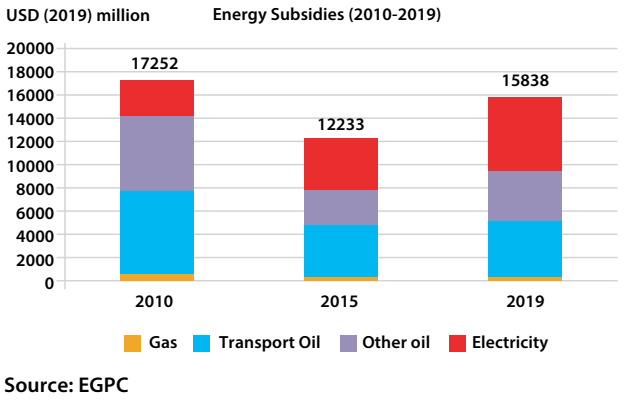
Vehicles fuel prices and subsidies

Vehicles fuel subsidies:

Energy prices in Egypt have been characterized for decades of being heavily subsidized and not reflecting its real cost or value, a situation that led to discouragement of any efforts towards energy efficiency improvements. Recognizing the importance of appropriate and effective energy pricing to the whole Egyptian economy; the government of Egypt started since July 2014 implementing the energy pricing reform program which aimed at increasing energy prices to reflect its real value and phasing out all energy price subsidies by 2022. However, and despite the effective implementation of the program energy subsidies accounted for $15.838 billion in 2019 compared to $12.233 billion

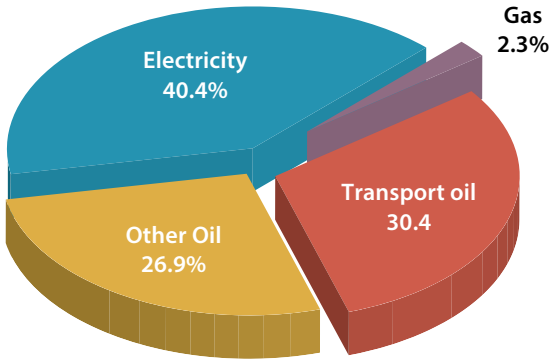
in 2015 with oil products and natural gas represented about 60% of total subsides in 2019 compared to about 40% for electricity as shown from figure (2.11-2.12).

Figure (2.13) presents oil products and natural gas direct subsidies during the period (1998/1999-2010/2011). As it is obvious from figure (2.12) transport sector fuel subsidy represented more than 30% of total energy subsides in Egypt in 2019.



Source: EGPC

Figure (2.11) Energy subsidy (2010-2019)



$ 15.838 Billion

Figure (2.12) Energy subsidy 2019

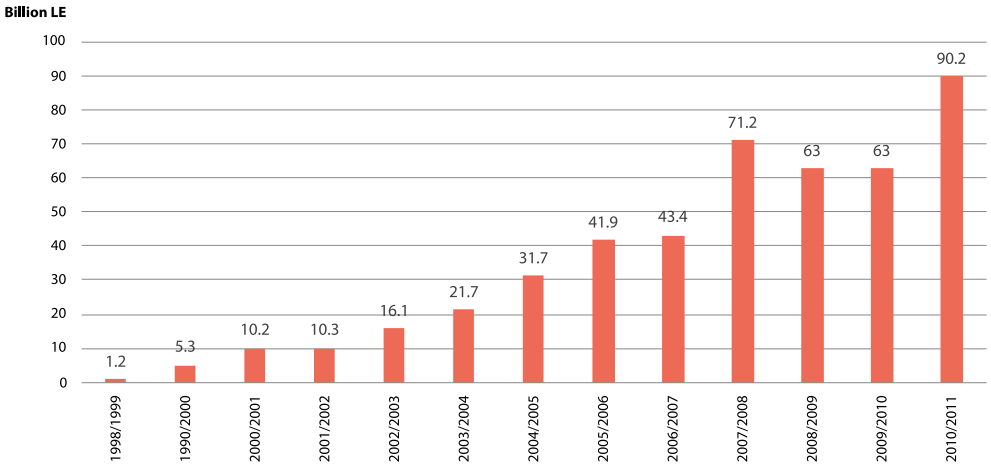


Figure (2.13) Oil products and natural gas direct subsidies (1998/1999-2010/2011)

Vehicles fuel prices:

Table (2.12) and figure (2.14) presents transport sector fuel prices development during the period (September 2014 to April 1st, 2022. As it is obvious from table (2.12) and figure (2.14), oil products (gasoline & diesel) and CNG prices for transport vehicles in Egypt achieved relatively high average annual growth rates during the first two periods of price increase and reform (Sep. 10, 2004 to July 5, 2014) and (July 5, 2014 to July 5, 2019) compared to that for the third period (July 5, 2019 to April 1, 2022). As an example, for gasoline 92 the average annual growth rate during the first and second periods estimated at 6% and 26% respectively and compared to only 2.5% during the third period reflecting the GoE intention to minimize the price increase negative impact on the Egyptian citizens while reforming the prices of fuels to reflect its real value.

Table (2.12) Vehicles fuels price development in Egypt

Date	Gasoline 80	Gasoline 92	Gasoline 95	Diesel	NGV	Average annual GR % of Gasoline 92
Sep. 10, 2004	0.9	1.4	1.75	0.6	0.4	6%
June 21, 2006	0.9	1.4	1.75	0.75	0.4	
Jan 1, 2011	0.9	1.85	2.75	1.1	0.4	
Nov. 15, 2012	0.9	1.85	5.85	1.8	0.4	
July 5, 2014	1.6	2.5	6.25	1.8	1.1	
Nov. 4, 2016	2.35	3.5	6.25	2.35	1.6	26%
June 24, 2017	3.65	4.5	6.6	3.65	2	
June 16, 2018	5.5	6.75	7.75	5.5	3.5	
July 5, 2019	6.75	8	9	6.75	3.5	
Oct. 4,2019	6.5	7.75	8.75	6.75	3.5	2.5%
April 11, 2020	6.25	7.5	8.5	6.75	3.5	
July 9, 2020	6.25	7.5	8.5	6.75	3.5	
Jan. 1, 2021	6.25	7.5	8.5	6.75	3.5	
April 23, 2021	6.5	7.75	8.75	6.75	3.5	
July 23, 2021	6.75	8	9	6.75	3.5	
Oct. 8, 2021	7	8.25	9.25	6.75	3.75	
April 1, 2022	7.25	8.5	9.5	6.75	3.75	

Source: https://www.thefuelprice.com/Feg/en

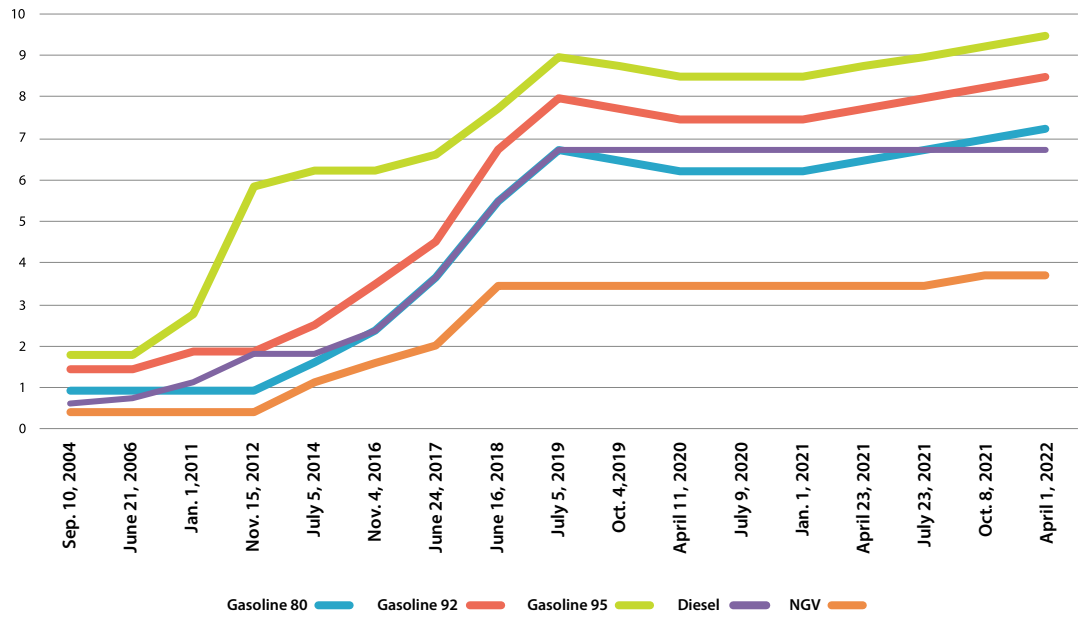


Figure (2.14) Vehicles fuels price development in Egypt

Recent policies and measures to regulate the automotive industry in Egypt:

Recognizing the importance of the automotive industry as one of the most important pillars in Egypt's industrial development, the following actions, measures and policies have been taken to regulate and promote the automotive market in Egypt:

- **In 2017,** the GOE announced the crafting of an automotive directive that would provide incentives to local assemblers to move further up the value chain into manufacturing in return for a measure of protection against EU, Moroccan and Turkish imports.
- **In December 2018,** the Minister of Trade and Industry confirmed that the GOE was working on a strategy to promote investments in the automotive sector in addition to concluding agreements with a number of OEMs to locally manufacture specific models in large numbers, and utilizing Egypt as an export hub for such models, in return for various tailor-made incentives that seek to enhance production and export capabilities.
- **In June 2019,** the Prime Minister's office announced the GOE's plan to develop a "national program" to promote the production of vehicles and its feeding industries in Egypt and to provide new incentives to stimulus domestic manufacturing and assembly through providing notable custom discounts on automotive components. The ultimate goal of the program was to enhance local car assemblers and manufacturers' ability to strengthen their market position and export their products to foreign markets.
- **In June 9th 2019,** and in order to build-up the upcoming automotive new policy, the Minister of Trade and Industry decided, to cancel his predecessor's decree no. 371/2018. The repealed decree had regulated the method of determining the percentages of local component manufactured in the automotive industry and its feeding industries, stipulating that the percentage of domestic manufacturing in the automobile industry should not be less than 46% (with a 1% annual increase), and that the contribution of the assembly line in the local manufacturing rate of the car should stand at 28%. According to the new decree, the locally manufactured components percentage is kept at 45%. In addition, the Ministry of Industry also decided to re-operationalize the decision of the Minister of Industry and Mineral Resources No. 136/1994, regarding the assessment of the contribution rate of assembly lines, as well as re-operationalize the Minister of Commerce's decision No. 907/2005.
- Floating the customs exchange rate: In September 2019, the GOE decided to revert back to setting the customs exchange rate on daily basis according to foreign Exchange (FX) rates by the CBE, after two years of setting it monthly.[1]

The Automotive Strategy:

On March 10th 2022, the Cabinet has announced that the prepared strategy for automotive industry development in Egypt has been reviewed. However, the Cabinet didn't announce a date for launching the strategy. According to the strategy, Egypt will establish itself as the main gateway for emerging market in Africa and will seek to build a strong commercial and investment relations with the main regional trade partners to ensure sustainable growth for both sides. The scope of the Egyptian Automotive Industry Development Program (AIDP) which is a component of the strategy includes: (1) providing the required framework to develop existing assembly and manufacturing capabilities, and (2) encourage new investments in the automotive sector. Vehicles which will be assembled under this program include passenger cars as well as SUVs, Vans, and microbuses. The program also provides incentives for the localization of electric vehicles manufacturing which include cash incentive that worth a maximum of LE 50,000 in addition to the already-applied exemption from vehicle license tax and the state resource development fee. The program also requires real estate developers to secure specific numbers of electric cars charging points in residential and commercial projects. In that regard, the first integrated fuel station for vehicles (gasoline, natural gas and electricity) has been inaugurated in July 2021 with plans to set up a network of 3000 electrical-charging stations in the near future. It is worth mentioning also that participation in the program is optional and that the strategy is in line with the World Trade Organization (WTO) rules. The strategy main pillars include: attracting further investments in the vehicle industry, create job opportunities, develop a competitive vehicle market, localize environment-friendly cars, reduce the dependence on fossil fuels, keep pace with global progress in the vehicle industry, etc.

2.12. Previously implemented policies and measures to improve LDVs energy utilization efficiency and reduce CO_2 emissions:

During the last few decades, several energy efficiency and policy reforms projects, programs and initiatives have been implemented in the transport sector in Egypt in order to minimize energy consumption, mitigate GHG and pollutants emissions and consequently improve air quality. Among the various policy reforms and measures that have been considered by the government of Egypt are the promotions and development of public transport, fuel switching to cleaner fuels (the use of CNG as a fuel for vehicles), upgrading of vehicles fleet, the development of transport infrastructure, traffic management, enhancing engine maintenance and tuning up, the Greater Cairo Region (GCR) Old Vehicles Scrapping and Recycling Programme (OVSRP), etc. The following is a brief on the most important implemented policies, programs, initiatives, and projects relevant to improving energy efficiency for LDVs in Egypt as one of the most significant energy consuming, GHG and pollutants emissions transport sector segments in Egypt.

Vehicle Scraping and Recycling Program (VSRP):

The OVSRP was initiated in 2009 with fuel saving and the reduction of GHGs emissions through scrapping and replacement of old vehicles with new and fuel-efficient ones as the main objectives. Other objectives of program included the creation of an effective mechanism for the enforcement of traffic law number 121 of the year 2008 which states that "mass transport vehicles of age of more than 20 years old are not eligible for new operating licenses or license renewal". According to the law, the mass transport vehicles include taxis, microbuses, trailer trucks, and buses.[8]

The Greater Cairo Region GCR's taxies were considered as the main target for the first phase of program implementation with consequent phases to consider other old mass transport vehicles such as microbuses, trailer trucks and buses and to include other regions in Egypt. Based on the program design document; taxi fleet in GCR accounted for 86,000 in 2009 of which 58% of an age of more than 22 years old, 24% of an age of more than 32 years and 7% of an age of more than 37 years. The average specific fuel consumption of new taxi vehicles estimated at 9.4 liters per 100 km compared to 13.2 liters per 100 km for old taxi which means fuel consumption efficiency improvement and reduction of pollutants emissions by 29%. The program was based on Public Private Partnership (PPP) and comprised several stakeholders including the Ministry of Finance (MoF), the Ministry of Interior (MoI), 2 local banks, 5 vehicles manufacturing companies, an insurance company, an advertising company, old vehicles owners, the Clean Development Mechanism Awareness and Promotion Unit (CDM AP), and the World Bank Carbon Finance Unit. The setup of program characterized by the well-defined role and responsibilities of all stakeholders, its design as one- stop-shop approach which facilities performing all program activities that range from old vehicles inspection and scrapping to financing and purchasing new vehicles at the same site. According to the project estimates, scraping and recycling of 49,000 old taxi vehicles and replacing them by new and fuel-efficient ones is expected to result in gasoline savings of about 0.4-0.7 million tons and consequently GHSs emission reduction of about 1.3- 2.3 million tons of CO_2 during the period (2013-2018) depending on the kilometers traveled by vehicles each year. It is worth mentioning that the implementation of the Vehicle Scraping and Recycling Program (VSRP) as one of the CDM project is based on the success of implementing two other phases. The pilot phase which implemented in 2005 resulted in replacing 763 old taxis in GCR and expected to reduce about 25,600 tons of CO_2 equivalents over a ten year period. The Second Phase which implemented in 2009 with the objective of replacing 8845 old taxi vehicles with new and efficient ones. The GHGs reduction of that phase estimated at about 300,000 ton of CO_2 equivalent over a ten year period. The other phases of the program in GCR included the scrapping and replacement of additional 40,000 taxi vehicles by new and efficient ones and consequently to reduce about 1.4 million tons of CO_2 equivalent over a ten year period. Unfortunately, the political and economic instability after the January 25th, 2011 resulted in project postponement.[9]

The use of Compressed Natural Gas (CNG) as a Fuel for Vehicles:

Recognizing the economic and environmental benefits of utilizing natural gas as a clean and abundant fuel compared to conventional alternative fuels such as LPG, gasoline, diesel, fuel oil, etc.; the government of Egypt started since the

early 1980s the implementation of an aggressive fuel switching policy to replace various alternative conventional fuels as previously mentioned by natural gas in different sectors and applications including its usage as a fuel for vehicles in the form of CNG. The utilization of CNG as a fuel for vehicles to replace gasoline and diesel started in Egypt by the early 1990s. By the end of 2020 total number of natural gas vehicles accounted for more than 335,000 natural gas vehicles fueled by compressed natural gas (CNG) through 225 CNG fueling stations. The relatively low natural gas compared to the price gasoline and diesel in addition to other incentives given by the Ministry of Petroleum (MoP) to natural gas vehicles NGVs operating companies were among the main drivers for the rapid and successful development of the NGVs industry in Egypt.

The recent initiative in 2020 for scrapping old vehicles:

The initiative considered as a continuation of the previous one implemented in 2009 was announced by the president of Egypt during the year 2020 to scrap all vehicles of more than 20 years old and replace it with new and efficient ones and with the ultimate goals of improving the Egyptian citizens' life standards, utilizing the clean energy and minimizing air pollutants. The initiative aims at replacing 250,000 old vehicles by new ones through two phases over 3 years of which 150,000 will be converted to operate using CNG. During the first year (phase one) 70,000 vehicles will be replaced by new ones of which 55,000 are private cars and 20,000 are other types of LDVs e.g. taxi and microbus. The first phase of the initiative or the project will comprise 7 governorates which are Cairo, Giza, Qalyubia, Alexandria, Suez, Red Sea, and Port Said, provided that the implementation will follow in the rest of the governorates of Egypt. The initiative includes a financial incentive for the participants called “green incentive”. The Cabinet Decision No. 130 on 10/2/2021 identified the categories of the financial incentive as follows:

- Owner 10% of the new car’s value, with a maximum of 22,000 pounds
- The taxi is 20% of the new car’s value, with a maximum of 45,000 pounds
- The microbus is 25% of the new car’s value, with a maximum of 65,000 pounds
- The Central Bank of Egypt (NBE) announced the creation of a credit line of LE 15 billion to finance the initiative/ projects with low interest rate of only 3%

3. Fuel economy & CO_2 emissions estimates (2017-2021)

3. Fuel economy and CO_2 emissions estimates (2017-2021)

The assessment of the existing situation of LDVs market in Egypt in addition to the estimates of its Fuel Economy (FE) and CO_2 emissions by the various makes and models is considered as the most important step in setting the appropriate and effective policies for improving LDVs fuel utilization efficiency and reducing the corresponding pollutant and GHG emissions.

3.1. Methodology Utilized:

The methodology utilized for estimating the average fuel economy and CO_2 emissions of different LDVs in Egypt and according to different manufactures (makes) and models during the years 2017 to 2021 relied mainly on the following approaches, basic assumptions and considerations:

1. The Global Environment Facility Initiatives (GEFI)1 approach and methodology which comprise the main steps for estimating the average FE and CO_2 emissions by different existing LDVs and according to various brands/ makes and models.
2. The Methodological Guide to Developing Vehicle Fuel Economy Databases2 prepared by the UNEP in 2011 which describes the process to be used in developing the vehicle fuel economy database.[10]
3. Data utilized include the following main items: Vehicle make, model, engine capacity or size (in liters of cubic centimeters CC), model production year, vehicle origin i.e. the country from which the vehicle is imported (Completely Built Unit CBU) or locally assembled Completely Knocked Down Unit (CKD), annual sales by each vehicle make and model, average fuel consumption or fuel economy (in liter per 100 Km), the sale price of different vehicles by brand and model, etc. A sample of data utilized in estimating the LDVs in Egypt is presented in appendix (1). In addition, other data and information utilized for analyzing the automotive market in Egypt were also collected. Examples include: (1) vehicle's production, imports, exports, and sales. (2) Existing automotive companies, (3) prevailing laws and regulations, (4) previously implemented policies and measures to improve sector energy utilization efficiency and reduce CO_2 emissions, etc.
4. As the origin of the various vehicles differ and accordingly the Driving Cycles (DCs) utilized to estimate the fuel economy of various vehicles makes and models, and for the sake of comparability it was necessary to convert and normalize all available FE figures obtained from vehicles manufacturers to the New European Driving Cycle (NEDC) using the corresponding equations provided by the GEFI and the previously mentioned Methodological Guide to Developing Vehicle Fuel Economy Databases. CO_2 emissions have been also converted using the emissions factors mentioned in the previously mentioned initiative (GEFI) and the Methodological Guide based on the ICCT conversion tool.
5. Data sources include the following: [11] - [16]

- The Automotive Marketing Information Council (AMIC).
- Some vehicles sellers websites and Databases such as:
  - https://egypt.yallamotor.com/new-cars
  - https://ellaithy.com.eg/en/
  - https://www.guideautoweb.com/
  - https://www.automotive-manuals.net/haval/
  - https://www.cardekho.com/
  - https://www.cars-directory.net/

1. GFEI is a joint initiative of UNEP, the International Energy Agency (IEA), the International Transport Forum (ITF), and the Fédération Internationale de l›Automobile (FIA Foundation) calling for the adoption of a global fuel economy roadmap, which should be embarked upon urgently and integrated into financial support of the global car industry.
2. The Methodological Guide to Developing Vehicle Fuel Economy Databases is a methodological guide that describes the process to be used in developing the vehicle fuel economy database.

3.2. Main Results
3.2.1. LDVs Passenger Cars Sales by Engine Size or Capacity 2017-2021:

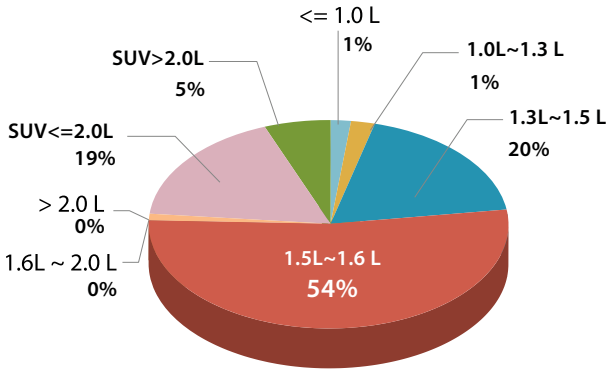
As shown from table (3.1-3.2) and figures (3.1-3.2), total LDVs sales has increased and almost more than doubled during the period (2017-2021) from 99530 vehicles in 2017 to 215072 vehicles in 2021 with an average annual growth rate of 21.2% during that period. The engine of (1.5L ~1.6 L size -medium I) represented the largest share of total vehicles sales during the period 2017-2021 with a maximum of 55.7% in 2020. During the year 2021, engine size of (1.5L ~1.6 L) represented the largest share of total vehicles sales during that year of 47.2% followed by the light SUV vehicles (SUV <= 2.0 L) of 22.9%, the small/medium (1.3L ~1.5 L) of 16.9%, the small vehicle of (1.0L ~ 1.3 L) of 6.3%, the medium II (1.6L ~ 2.0 L) of 4.9%, the SUV (SUV > 2.0 L) of 1.4% share and finally the compact (<= 1.0 L) of only 0.2%

Table (3.1) Passenger Cars Sales by Engine Size or Capacity (2017-2021)

Segment	Engine Capacity (cc)	2017	2018	2019	2020	2021	(2019 /2018) Percentage Change
Compact	<= 1.0 L	1346	2119	852	1112	479	-59.8%
Small	1.0L ~ 1.3 L	999	853	521	3371	13575	-38.9%
Small/ Medium	1.3L ~1.5 L	19797	29150	29839	23511	36438	2.4%
Medium I	1.5L ~1.6 L	53402	76200	61351	93378	101550	-19.5%
Medium II	1.6L ~ 2.0 L	158	64	125	8120	10541	95.3%
Large	> 2.0 L	39	47	47	37	22	0.0%
Light SUV	SUV <= 2.0 L	19293	34287	31771	35398	49350	-7.3%
SUV	SUV > 2.0 L	4496	3166	2937	2865	3117	-7.2%
Total		99530	145886	127443	167792	215072	11.6%

Table (3.2) Passenger Cars Sales by Engine Size or Capacity share (2017-2021)

Segment	Engine Capacity (cc)	2017	2018	2019	2020	2021
Compact	<= 1.0 L	1.4%	1.5%	0.7%	0.7%	0.2%
Small	1.0L ~ 1.3 L	1.0%	0.6%	0.4%	2.0%	6.3%
Small/ Medium	1.3L ~1.5 L	19.9%	20.0%	23.4%	14.0%	16.9%
Medium I	1.5L ~1.6 L	53.7%	52.2%	48.1%	55.7%	47.2%
Medium II	1.6L ~ 2.0 L	0.2%	0.0%	0.1%	4.8%	4.9%
Large	> 2.0 L	0.0%	0.0%	0.0%	0.0%	0.0%
Light SUV	SUV <= 2.0 L	19.4%	23.5%	24.9%	21.1%	22.9%
SUV	SUV > 2.0 L	4.5%	2.2%	2.3%	1.7%	1.4%
Total		100.0%	100.0%	100.0%	100.0%	100.0%



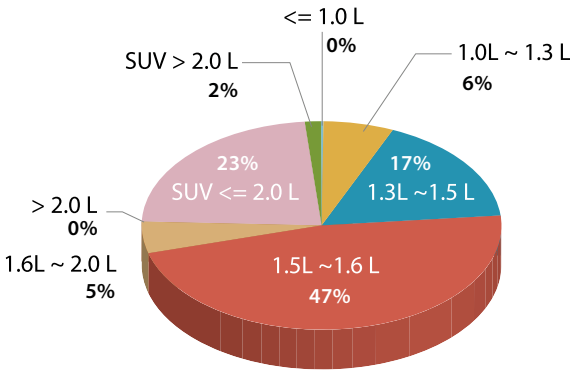
Total= 99530

Figure (3.1) Passengers Cars Sales by Engine Size share (2017)

3.2.2. Average Fuel Economy and CO_2 Emissions from LDVs Passenger Cars in Egypt 2017-2021:

As shown from table (3.3) and figures (3.3 -3.4):

- The fuel economy of LDVs in Egypt estimated at an average of 6.02 L/100 Km during the 5 years period of estimates (2017-2021) with the maximum value of 6.45 L/100 Km in the year 2019 and a minumum of 5.78 L/100 Km in 2018.
- At the same time, CO_2 emissions from LDVs in Egypt estimated at an average of 140 g/Km during the 5 years period (2017-2021) with the maximum value of 151 g/Km in 2019 and a minumum of 134 g/Km in 2018.
- The increase of the average FE and accordingly CO_2 emission in 2019 compared to 2018 is attributed to the large drop in vehicles of small engine size sales, particularly those of <= 1.0 L, 1.0L ~ 1.3 L, and 1.5L ~1.6 L which characterized by having lower FE and CO_2 emissions values compared to the slight decrease in vehicles sales of larger engin size (of 2 L/100 Km or more) which characterized of having high FE and CO_2 emissions values as shown from table (3.1).



Total= 215072

Figure (3.2)Passengers Cars Sales by Engine Size share (2021)

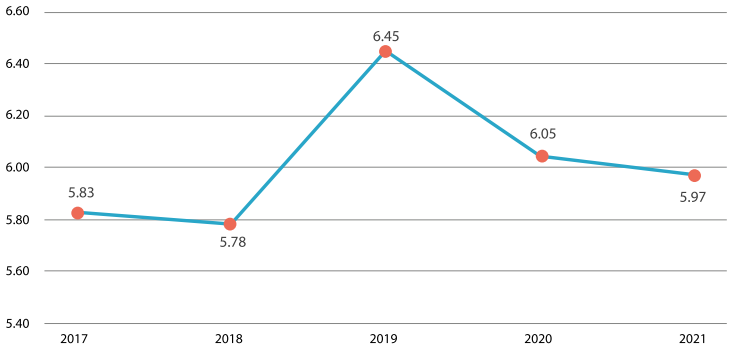


Figure (3.3) Average Fuel Economy for LDVs Passenger Cars in Egypt 2017-2021 (L/100 Km)

Table (3.3) Average Fuel Economy and CO_2 Emissions from Passenger Cars in Egypt (2017-2021)

	2017	2018	2019	2020	2021	Average of 5 years
Fuel Economy (L/100KM)	5.83	5.78	6.45	6.05	5.97	6.02
CO_2 (g/Km)	136	134	151	141	140	140

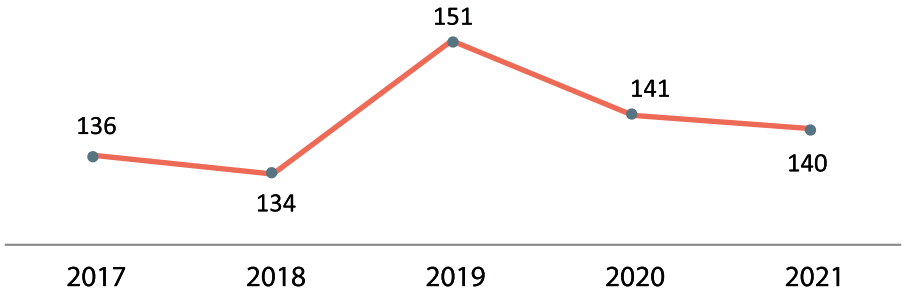


Figure (3.4) Average CO_2 Emissions from LDVs Passenger Cars in Egypt 2017-2021 (g/Km)

3.2.3. LDVs Passenger Cars Average Fuel Economy by Engine Size or Capacity 2017- 2021:

As shown from table (3.4) and figures (3.5 – 3.6):

- The SUV LDVs of engine size of more than 2 L had the largest fuel economy during the years 2017 to 2021 of equal or more than 10.5 L/100 Km (10.6 on average).
- Meanwhile, the compact and small LDVs with engine size of less than 1 L and 1.0L ~ 1.3 L respectively had the smallest fuel economy during the years 2017 to 2021 of 4.8 on average during that period.

Table (3.4) LDVs or Passenger Cars Average Fuel Economy by Engine Size or Capacity 2017-2021 (L/100 km)

Segment	Engine Capacity (cc)	2017	2018	2019	2020	2021	Average of 5 years
Compact	<= 1.0 L	6.3	5.7	4.3	4.0	3.4	4.8
Small	1.0L ~ 1.3 L	4.3	4.5	4.9	5.1	5.0	4.8
Small/ Medium	1.3L ~1.5 L	5.5	5.6	5.8	5.6	5.4	5.6
Medium I	1.5L ~1.6 L	5.6	5.7	7.0	6.1	6.1	6.1
Medium II	1.6L ~ 2.0 L	5.6	6.1	8.1	6.8	6.8	6.7
Large	> 2.0 L	5.0	5.8	5.8	7.7	7.4	6.3
Light SUV	SUV <= 2.0 L	5.7	10.8	5.8	5.8	5.9	6.8
SUV	SUV > 2.0 L	10.8	10.8	10.5	10.6	10.5	10.6
Total		**5.8**	5.8	6.5	6.0	6.0	6.0

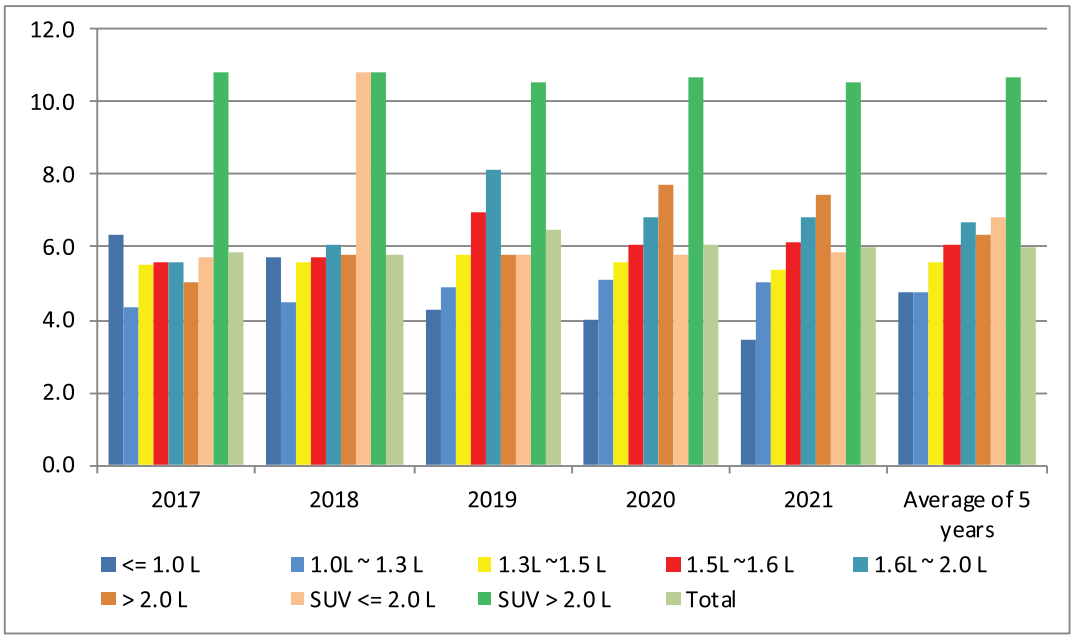


Figure (3.5) LDVs Passenger Cars Average Fuel Economy by Engine Size or Capacity 2017-2021 (L/100 km)

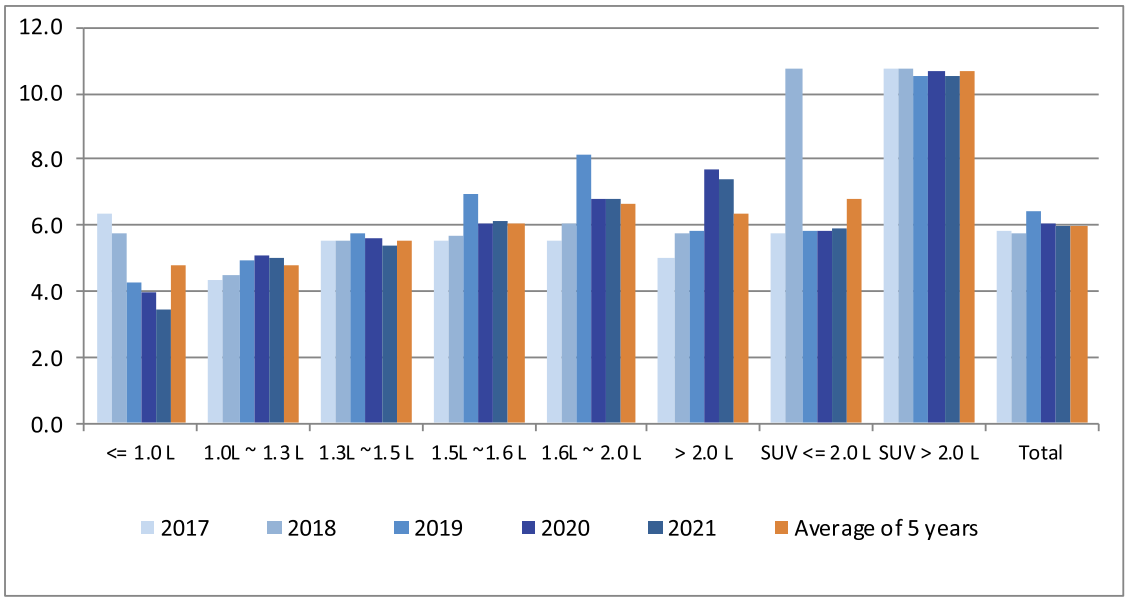


Figure (3.6) LDVs Passenger Cars Average Fuel Economy by Engine Size or Capacity 2017-2021 (L/100 km)

3.2.4. LDVs Passenger Cars Average CO_2 Emissions by Engine Size or Capacity 2017- 2021:

As shown from table (3.5) and figures (3.7 – 3.8):

- The SUV LDVs of engine size of more than 2 L had the largest CO_2 emissions during the years 2017 to 2021 of equal or more than 246 g/ Km (249 g/km on average).
- Meanwhile, the compact and small LDVs with engine size of less than 1 L and 1.0L ~ 1.3 L respectively had the smallest CO_2 emissions during the years 2017 to 2021 of 111 and 112 g/km on average during that period.

Table (3.5) LDVs or Passenger Cars Average CO2 emissions by Engine Size or Capacity 2017-2021 (g/ km)

Segment	Engine Capacity (cc)	2017	2018	2019	2020	2021	Average of 5 years
Compact	<= 1.0 L	148	134	101	94	80	111
Small	1.0L ~ 1.3 L	102	104	115	119	118	112
Small/ Medium	1.3L ~1.5 L	129	130	135	131	126	130
Medium I	1.5L ~1.6 L	130	133	163	143	144	143
Medium II	1.6L ~ 2.0 L	118	142	152	159	159	146
Large	> 2.0 L	185	186	190	181	173	183
Light SUV	SUV <= 2.0 L	134	135	136	136	138	136
SUV	SUV > 2.0 L	252	252	246	249	247	249
	Total	**136**	134	151	141	140	140

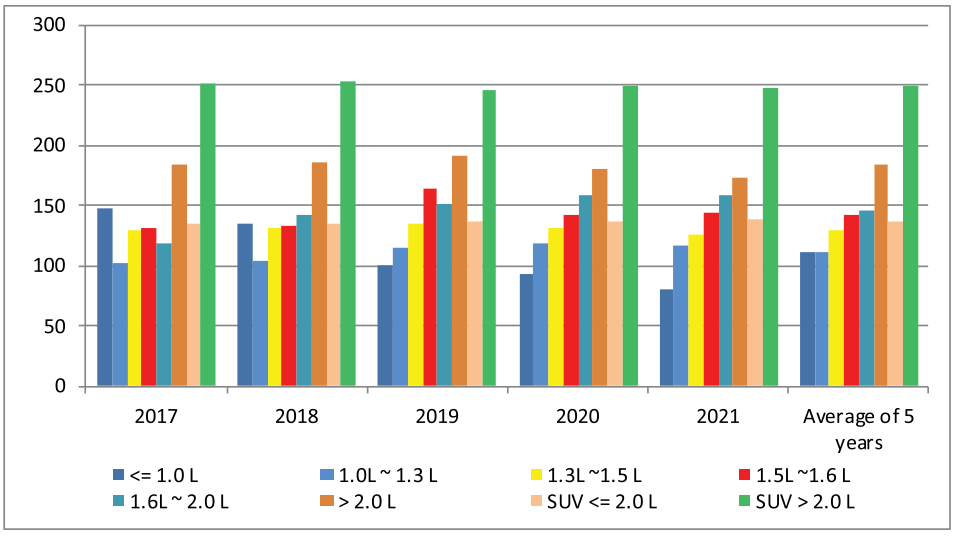


Figure (3.7) LDVs or Passenger Cars Average CO_2 emissions by Engine Size or Capacity 2017-2021 (g/ km)

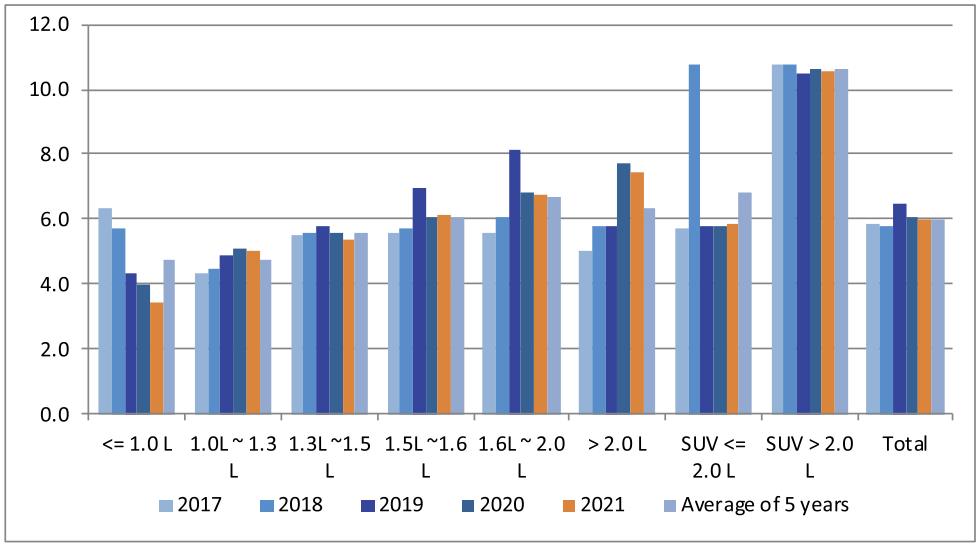


Figure (3.8) LDVs or Passenger Cars Average CO2 emissions by Engine Size or Capacity 2017-2021 (g/ km)

3.2.5. Fuel Economy in Major Car Markets Worldwide: [18]

The latest published report of the IEA in March 2020 titled "Fuel Economy in Major Car Markets: Technology and Policy Drivers 2005-2017", addressed the following Key findings for market status of new light-duty vehicles:

- The global average fuel consumption of newly registered 10 light-duty vehicles (LDVs) reached 7.2 liters of gasoline-equivalent per 100 kilometers (Lge/100 km) in 2017 within an LDV market where sales have grown by around 10% between 2015 and 2017 (figure 3.9).
- The average fuel consumption between countries differs substantially among countries, ranging between 5.2 Lge/100 km and 8.9 Lge/100 km.
- Countries can be clustered in three main groups:
  - Advanced economies with a gasoline price below USD 1/L - Australia, Canada and the United States, where average fuel consumption is in the 7.9 to 9 Lge/100 km range.
  - Advanced economies; with gasoline prices above USD 1/L - European Union, Turkey, Japan and Korea, where fuel use per kilometer ranges between 5.2 and 6.5 Lge/100 km.
  - Emerging economies, with average fuel consumption in the 6.5 to 8.5 Lge/100 km range, with India - which has a fuel consumption of 5.6 Lge/100 km - as an outlier.
- Average LDV fuel economy improved in all regions between 2005 and 2017,through which there was a wide divergence of absolute levels and trends between countries and regions.

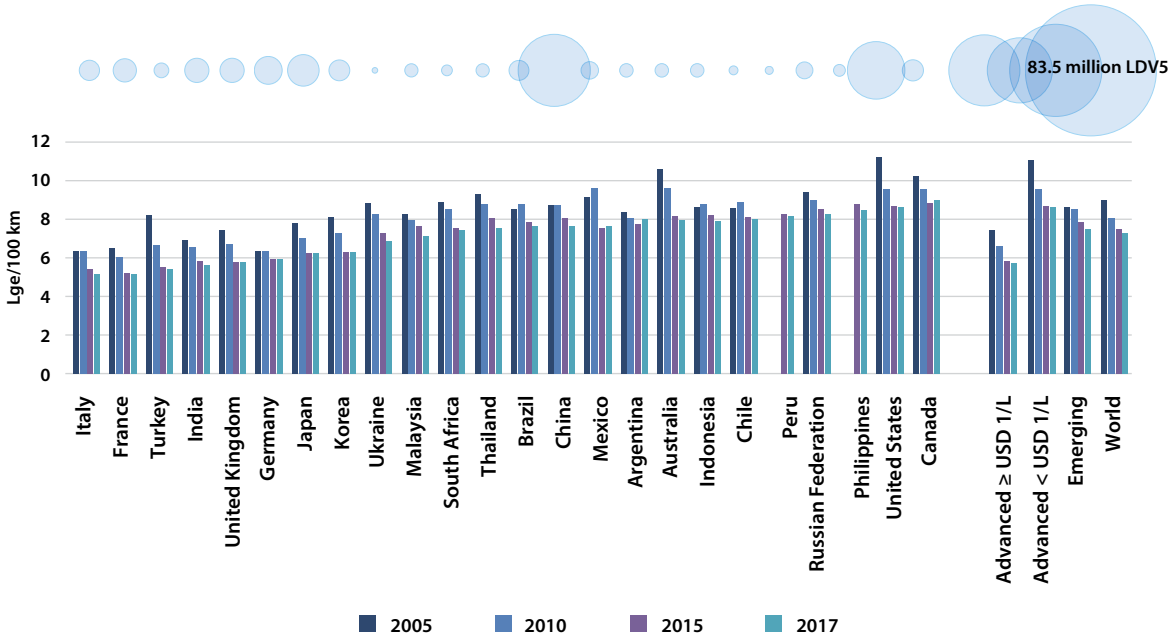


Figure (3.9) Average new LDV fuel economy by country or region (2005-17) and new registrations (2017)

4. Main conclusions, recommended policies & measures

4. Main conclusions and recommended policies and measures

4.1. Main Conclusions:

The current study: "Fuel Economy and CO_2 Emissions of LDVs in Egypt" shows that:

- The fuel economy of LDVs - passenger cars in Egypt estimated at an average of 6.02 L/100 Km during the 5 years period of estimates (2017-2021) with the maximum value of 6.45 L/100 Km in the year 2019 and the minimum of 5.78 L/100 Km in 2018.
- At the same time, CO_2 emissions from LDVs in Egypt estimated at an average of 140 g/Km during the 5 years period (2017-2021) with the maximum value of 151 g/Km in 2019 and a minimum of 134 g/Km in 2018.
- The average fuel economy in the year 2017 was 5.83 L/100 Km; which was less than estimated global average during the same year of 7.2 L/100 Km.
- The last three years; the period (2019-2021), have witnessed a decline or an improvement in LDVs Fuel Economy in Egypt estimated at 7.4% from 6.45 L/100 Km in 2019 to 5.97 L/100 Km in 2021 and with an average decline rate of 3.8% during that period reflecting Egypt's possibility to achieve the Global Fuel Economy Initiative (GFEI) Fuel Economy target of 4 L/100 Km by 2030.
- Moreover, the automotive industry has become increasingly globalized as OEM outsource a large portion of their manufacturing processes with countries such as China, India, turkey, Thailand, Brazil, Poland, Romania and others emerged as major players and cheap locations to assemble Completely Knocked Down (CKD) and Semi-Knocked Down (SKD) vehicles kits, and as producers of specific components and spare parts that are shipped internationally to assembly sites in other countries. In that regard, and as Egypt stands the chance to grow as a regional influential automotive player, several policies and measures are recommended to be implemented.

4.2. Recommended policies and measure:

In order to achieve the previously mentioned GFEI's target of 4 L/100 Km by 2030 while guarantee the growth of the automotive market and industry in Egypt, a set of effective fuel economy recommended policies and measures need to be implemented, the most important of which include the following:

- The implementation of mandatory standards, impact restriction/incentives (e.g. incentivizing low-sulfur fuel, efficient or electric vehicles, etc.),
- The continuation of implementing the recently developed vehicles scrapping programme for LDVs and extend it to cover other vehicles segments (e.g. microbuses, buses, etc.) in the future,
- The creation of Low-Emission Zones (LEZ) in some eligible cities in Egypt, especially leveraging the unprecedented rapid advancement in developing toll-station networks around cities in Egypt and Intelligent Transport Systems (ITS) infrastructure,
- Provide attractive and effective economic incentives/disincentives e.g. tax exemptions or reduction for cleaner cars, feebate schemes, fuel taxation or CO_2 taxation, etc.,
- Provide special exemptions for advanced technologies (e.g. exemption from congestion charges, car pool lane privilege, etc.),
- Conducting regular inspection and maintenance programmes for vehicle to ensure its compliance to the permissible fuel economy norms and standards,
- Implementing awareness and information provision (e.g. labeling, consumer awareness, reporting, etc.) which also facilitates the implementation of other tools (e.g. labeling facilitates imposing minimum mandatory standards),
- Based on the gained experience, challenges and occurred difficulties in performing the current study, particularly that relevant to data availability, it is quite obvious that there is a specific and urgent need for the establishment of a Fuel Economy Information Management System (FEIMS) either standalone or as a part of relevant entities databases or information systems (e.g. CEDARE, the AMIC, CAPMAS, etc.).

- There is a need that the GOE play more influential role in the planning and expansion of the automotive industry in Egypt through affording the right incentives to encourage foreign companies to produce efficient vehicles rather than assemble domestically. Meanwhile, the government has to provide the necessary and appropriate support to local manufacturers in addition to encouraging the Research and Development (R&D) in the auto industry in Egypt.
- Need for strong political support for local manufacturers and continue the dialogue with key industry players to develop an automotive policy. This policy may include the following incentives, which should be reviewed and updated every 5 years:
  - Customs incentives: Introducing amendments to the Customs Act, providing customs discounts to car manufacturers in return for increasing their use of local components.
  - Tax breaks: Provide tax exemptions or reduction for OEMs and feeding companies: VAT exemptions, income tax exemptions and/or corporate tax reduction.
  - Exportincentives:Providingfurtherexport-basedincentivesproportionatetolocalcomponentinput.This may include direct subsidies; direct pay backs, low-cost loans, tax exemption on profits made from exports and government financed international advertising.
  - Infrastructure preferential prices: Offering competitive costs and facilitated procedures for land and infrastructure allocated for automotive factories and research and development (R&D) facilities.
  - Expedite approval process: Review with the goal of simplifying and shortening- FDI approval procedures, on land allocation, registration and licensing, customs and taxes. Export support and subsidies are available in Egypt but further export support could be for automotive manufacturers.
- Attract automotive R&D investments: Developing an incentives program for R&D centers in Egypt, including automotive R&D, is likely to increase investments from OEMs and feeding industries. To achieve this, an incentives package, carefully crafted for the R&D industry, may include:
  - Patent related incentives: Providing incentives for researchers to register their patent in Egypt and/or import their patent from abroad for registration in Egypt.
  - Fiscal stimulus: Providing a tax break for companies developing technology related products and/or having R&D projects, product development, production or commercialization of technology oriented products.
  - A technology development fund: Create a technological foundation fund to provide financial support to innovative projects, proposed by individual firms or groups of enterprises in the R&D sector. Selection is geared towards projects involving the development of new products, services or processes.
  - Scholarships: Supporting scholarships for researchers to work on R&D in relevant firms and thus stimulate linkages between the private sector and academia. The goal is to strengthen firm's capacity to innovate by placing R&D personnel in firms and provide professional development opportunities for scholars.
  - R&D equipment imports: Providing custom duties exemption for imported equipment used in R&D related activities.
- Develop a comprehensive, well thought out e-mobility strategy that takes into account several important issues among which are the following: (1) Egypt's market potential, national readiness and policy framework, (2) the assessment of relevant technical aspects (proposed size, electricity requirements, costs, configuration, etc.), (3) Project risks, ownership and actors involved, (4) Potential economic benefits l(including reduced energy use and environmental benefits on air quality and emissions), (5) Identifying additional investment needs and benefits (in terms of reduced energy use and reduced environmental impacts), and (6) assessing the overall impact of the strategy and take up of electric vehicles on energy demand should also be carefully considered. The strategy should also seek to set out alternative charging infrastructure business models, based on an analysis of successful business models in other countries (such as the Netherlands and Norway).
- Consider restriction in the new motor traffic law- on licensing passenger vehicles that are 30-years old or longer after thoroughly studying the implications of such a decision.
- This decision will also have a notable environmental and health impact, taking into consideration that over

50% of passenger vehicles on Egypt's streets are more than 15-years old, which leads to higher consumption of gasoline.

- Seek to ensure market stability and growth by enhancing the predictability of policies and regulations associated with the automotive sectors and feeding industries.[1]

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Appendix (1)

A sample of data utilized in estimating LDVs in Egypt average Fuel Economy FE and CO_2 emission

Brand	Model	Engine Capacity (Liter)	Segment (1)	Segment (2)	Origin	FE (L/100 Km) 2021 X	NEDC Eq. FE (L/100 km) Y=X/CF	CO2 emissions (g/km)	Brand Origin	Segment (3)	Total 2021	Segment Volume Share 2021	Market Volume Share 2021
Chevrolet	SPARK	1	<= 1.0 L	Car-A	CBU				US	Mini	0	0.0%	0.0%
FORD	FOCUS 1.0l Ecoboost	1	<= 1.0 L	Car-C	CBU				US	Lower Medium	0	0.0%	0.0%
FORD	ALL NEW FIESTA	1	<= 1.0 L	Car-B	CBU				US		0	0.0%	0.0%
SUZUKI	New Alto 800	0.8	<= 1.0 L	Car-A	CBU	4.2	3.4	80	Japan	Mini	479	100.0%	0.2%
SUZUKI	Alto K10	1	<= 1.0 L	Car-A	CBU				Japan	Mini	0	0.0%	0.0%
SUZUKI	Alto	0.8	<= 1.0 L	Car-A	CBU				Japan	Mini	0	0.0%	0.0%
SUZUKI	M800 MARUTI	0.85	<= 1.0 L	Car-A	CBU				Japan	Mini	0	0.0%	0.0%
ZOTYE	Z100 Elegant-MT	1	<= 1.0 L	Car-A	CBU				China		0	0.0%	0.0%
Sub-total			**<= 1.0 L**								479	100%	0%
Chevrolet	New Spark	1.2	1.0L ~ 1.3 L	Car-A	CBU				US	Mini	0	0.0%	0.0%
Citroen	C3 Aircross	1.2	1.0L ~ 1.3 L	SUV-B	CBU	5.6	5.6	131	Europe		729	5.4%	0.3%
Citroen	New C3 HB	1.2	1.0L ~ 1.3 L	Car-B	CBU	5.6	5.6	131	Europe		282	2.1%	0.1%
Citroen	New C4	1.2	1.0L ~ 1.3 L	SUV-B	CBU	5.6	5.6	131	Europe		440	3.2%	0.2%
SUZUKI	Celerio	1	1.0L ~ 1.3 L	Car-A	CBU				Japan	Small	0	0.0%	0.0%
FIAT	Panda	1.2	1.0L ~ 1.3 L		CBU				Europe		0	0.0%	0.0%
FORD	FIESTA	1.25	1.0L ~ 1.3 L	Car-B	CBU				US	Small	0	0.0%	0.0%
HYUNDAI	i10	1.1	1.0L ~ 1.3 L	Car-A	CBU				S.Korea	Small	0	0.0%	0.0%
HYUNDAI	Grand i10	1.25	1.0L ~ 1.3 L	Car-A	CBU				S.Korea		0	0.0%	0.0%
KIA	New Picanto	1.2	1.0L ~ 1.3 L	Car-A	CBU				S.Korea	Mini	0	0.0%	0.0%
MITSUBISHI	Attrage	1.2	1.0L ~ 1.3 L	Car-B	CBU				Japan	Lower Medium	0	0.0%	0.0%
MITSUBISHI	LANCER	1.3	1.0L ~ 1.3 L	Car-C	CBU				Japan	Lower Medium	0	0.0%	0.0%
OPEL	Crossland X	1.2	1.0L ~ 1.3 L	SUV-B	CBU	4.8	4.8	112	Europe		1544	11.4%	0.7%
PEUGEOT	2008	1.2	1.0L ~1.2 L	SUV-B	CBU				Europe	Lower Medium	0	0.0%	0.0%
Renault	MEGANE HB	1.2	1.0L ~ 1.3 L	Car-C	CBU				Europe	Lower Medium	0	0.0%	0.0%
Renault	MEGANE GRAND COUPEE	1.2	1.0L ~ 1.3 L	Car-C	CBU				Europe	Lower Medium	0	0.0%	0.0%
SUZUKI	Swift Dzire	1.2	1.0L ~ 1.3 L	Car-B	CBU	6	5.0	117	Japan	Small	4328	31.9%	2.0%
SUZUKI	Swift H.B	1.2	1.0L ~ 1.3 L	Car-B	CBU	6.2	5.2	122	Japan	Small	4082	30.1%	1.9%
SUZUKI	S-Presso	1	1.0L ~ 1.3 L	Car-A	CBU	5.4	4.5	105	Japan	Small SUV	2170	16.0%	1.0%
TOYOTA	Avanza	1.3	1.0L ~ 1.3 L	MPV-B	CBU				Japan	Small	0	0.0%	0.0%
TOYOTA	Yaris Sedan	1.3	1.0L ~ 1.3 L	Car-B	CBU				Japan	Small	0	0.0%	0.0%
TOYOTA	Yaris HB	1	1.0L ~ 1.3 L	Car-B	CBU				Japan	Hatchback	0	0.0%	0.0%
Sub-total			**1.0L ~ 1.3 L**								13575	100%	6.3%

UN environment programme

GLOBAL FUEL ECONOMY INITIATIVE
FOR ZERO-CARBON VEHICLES BY 2050

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