



# **Fuel Economy and CO<sub>2</sub> Emissions of Light-Duty Vehicles in Morocco**

Centre for Environment and Development for the Arab Region and  
Europe  
(CEDARE)  
February, 2015

## CONTENTS

1	Introduction .....	5
1.1	Objectives .....	5
2	Background .....	6
2.1	Local air pollution and carbon emissions .....	7
2.2	Vehicle Stock and car ownership.....	7
2.3	Automotive Industry.....	8
3	Regulations and policy environment.....	10
3.1	Fuel Subsidies .....	10
3.2	Social aspects of fuel price hikes.....	11
3.3	Customs and taxation .....	11
4	Methodology .....	13
5	Results and Discussion .....	15
5.1	Average annual fuel economy in global context.....	17
6	Conclusions.....	18
6.1	Monitoring, Evaluation and Information Exchange.....	18
6.2	Future Studies.....	19
7	References.....	20

### **Annexes**

ANNEX-1: GFEI CLASSIFICATION OF LDVS

ANNEX-2: SAMPLE OF LDV DATA

## List of tables

Table 1: Taxes by fiscal (taxable) horsepower categories .....	11
Table 2: Proportionate interest.....	12
Table 3: Top 10 LDV models in 2013 in Morocco.....	15
Table 4: Average annual CO2 emission rate (gCO <sub>2</sub> /km) of new LDVs in Morocco .....	16
Table 5: Annual average fuel economy of new LDVs in context (units: l/100km, based on NEDC driving cycle).....	17

## List of figures

Figure 1: Sales of new LDVs in Morocco .....	6
Figure 2: Passenger cars and total motor vehicles in Morocco, 2005-2011 (based on WB Databank data) .....	8
Figure 3: Trends of transportation fuel prices in Morocco in US-cents/liter for diesel and super gasoline respectively (GIZ, 2014).....	10
Figure 4: Average Fuel Economy of new LDVs (l/100km) in Morocco in recent years.....	15
Figure 5: Distribution of engine sizes (liters) of new LDVs in Morocco in 2013 .....	16

## TABLE OF ACRONYMS

ACRONYM	DESCRIPTION
AfDB	African Development Bank
AMICA	Association Maroccaïne pour l'Industrie et le Commerce de l'Automobile
CEDARE	Center for Environment and Development for the Arab Region and Europe
CO <sub>2</sub>	Carbon Dioxide
CAMRE	Council of Arab Ministers Responsible for the Environment
DH	(Moroccan) Dirham
HP	Horsepower
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GFEI	Global Fuel Economy Initiative
GNI	Gross National Income
IMF	International Monetary Fund
LAS	League of Arab States
LDV	Light Duty Vehicle
MEWA	Middle East and West Asia
NEDC	New European Driving Cycle
OECD	Organization for Economic Cooperation and Development
OICA	Organisation Internationale des Constructeurs d'Automobiles
SOMACA	Moroccan Automobile Construction Company
SUV	Sports Utility Vehicles
UNEP	United Nations Environment Programme
WB	World Bank
WTO	World Trade Organization

# 1 INTRODUCTION

As part of the Global Fuel Economy Initiative (GFEI) and the strategic partnership between the Center for Environment and Development for the Arab Region and Europe (CEDARE) and the United Nations Environment Programme (UNEP) under the program entitled "Improving Fuel Quality and Fuel Economy in Middle East & West Asia (MEWA)", the present study aims to assess and fuel economy and carbon emissions of light duty vehicles in Morocco and to review relevant regulations. This case study contributes to the global effort to reduce fuel-dependence, improve vehicle fleet technologies, and mitigate the environmental and economic impact of inefficient vehicles in pursuit of a more sustainable transport sector.

The scope of this report is limited to new Light Duty Vehicles (LDVs). Future studies may also address on-road vehicles (i.e. the entire stock) and the rest of vehicle classifications.

The report firstly presents background about the context surrounding the automotive industry in Morocco and the associated environmental, economic and social aspects. An overview of the industry is then presented with a brief summary of the relevant regulations related to the LDVs in Morocco and the policy environment. The methodology for data collection, calculations and analysis is then explained and the results are presented and discussed. Recommendations for regulations and future studies are presented in the final section of the report.

## 1.1 OBJECTIVES

The overall aim of this study is to present the case study of Morocco in terms of the state of the vehicle fuel economy and carbon emission trends of new LDVs in the past years. It is presented in the context of the Global Fuel Economy Initiative (GFEI) target to reduce the global average of *new* LDVs from 8 L/100 km today to 4 L/100 km (50%) by 2030, and to further achieve this 50% reduction for the entire LDV stock by 2050;the *50-by-50* target.

The specific objectives of this study are as follows:

1. Report on the average fuel economy for *new* light duty vehicles in Morocco and its trend over time.
2. Present follow-up recommendations for policy-makers and regulators.

## 2 BACKGROUND

Morocco is a North African and Arab country with a growing population of 33 million. It is classified as a *low-middle-income* economy according to the World Bank classifications based on GNI per capita (WB, 2014). Morocco had an average GDP growth rate of 4% over the years of 2011-2013 (World databank, 2014). The cities of Casablanca, Rabat, Fes, Meknes and Agadir are specifically highly urbanized and characterized with high travel demand.

Morocco has a thriving industrial sector. Among the preferred sectors for foreign direct investment (FDI) are automotive, aeronautic, electronic, food processing, offshore activities and marine products, which together contribute an average 30% to GDP (Ernst & Young, 2011). One of the challenges of development however is that Morocco is highly dependent on import to meet its energy needs (AfDB, 2012).

Morocco's automotive industry has been experiencing significant growth in the past years, providing for both the local market and for export. In 2012, its global market share of automotive exports reached 0.23% exceeding the shares of the competing neighbouring countries Tunisia and Egypt (Office des Changes, 2013). With regards to the domestic market, Figure 1 shows the total sales of LDVs in the past years.

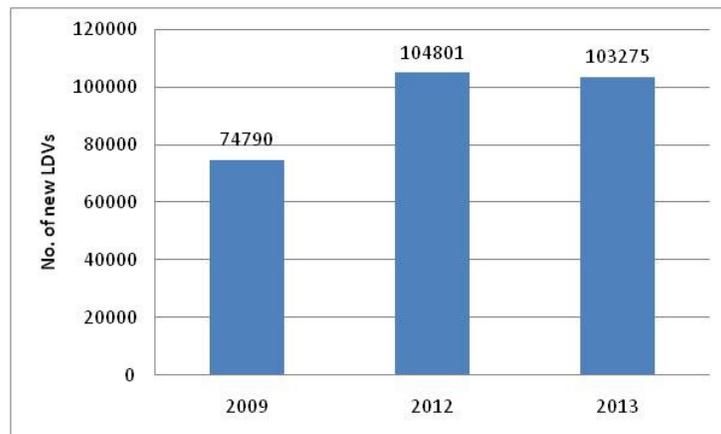


Figure 1: Sales of new LDVs in Morocco

The steady GDP growth and the low population growth rates compared to Arab countries are accompanied by a steady increase of total vehicle stock, from 2.36 million to 2.72 million vehicles on the road between 2009 and 2012 (OICA, 2012). Likewise, sales of Light Duty Vehicles (LDVs) have shown steady increase in the past years as illustrated in Figure 1.

Further growth in vehicle sales is expected by some market researchers to be as high as 8.3% in 2015 as compared to 2014, a significant rise, with passenger cars specifically growing faster than other vehicle categories (BMI, 2014).

A significant portion of new LDVs in Morocco is diesel fueled, often more than three quarters of the sales, while the rest is gasoline-fueled.

## 2.1 LOCAL AIR POLLUTION AND CARBON EMISSIONS

The transport sector in Morocco is a significant contributor to national carbon emissions. About one quarter of energy consumption in Morocco is attributed to the transport sector alone (El-Oalja, 2010). Furthermore, with regards to local air pollutants, air pollution from vehicle emissions are especially of significance in urban areas in Morocco, especially in the zone of Rabat-Casablanca where about 50% of vehicles are concentrated in this city alone (Van Breusegem et al. 2011). Epidemiologic studies conducted in Casablanca, Mohammedia and Safi found correlations between air pollution and increased respiratory infections, bronchitis, asthma, and premature mortality (Van Breusegem et al. 2011).

However, other sources of air pollution overshadow the transport sector. For example, in 2008, the ministry of equipment and transport conducted an assessment of air pollution from main polluting sectors in urban areas in 2005 (UNECA/OECD, 2014). The study found that global emissions of SO<sub>2</sub> were generated mainly by thermal power plants (60%) and by the refinery industry (29%); NO<sub>x</sub> emissions were also mainly attributed to thermal power plants and refineries (79%), by industry (12%) and to a lower extent diesel cars (7%)(UNECA/OECD,2014). The transport sector is therefore among the considered pollution sources, but it is overshadowed by industrial emissions<sup>1</sup>.

There has been substantial awareness and proactive response to the threats of air pollution in Morocco, and significant improvement has been made since 2009 due to improvement of fuel quality. In the 2010 forum of the partnership for cleaner fuels and vehicles, the case of Morocco in promoting cleaner fuels was presented as a success story in the context of the Middle East and North Africa (MENA) region, having eliminated leaded gasoline fuel and also introducing low-sulphur (50ppm) diesel fuel nationally (CEDARE, 2010). Prior to that, sulphur levels were amongst the highest worldwide at 10,000 ppm in diesel fuel for vehicles. Sulphur was reportedly reduced by 55,000 tons per year as a result (El-Oalja, 2010).

Morocco almost entirely depends on imports for its energy needs, and its domestic supply of oil and gas is negligible (AFDB, 2012). This might have facilitated the switch to cleaner fuels since it is not significantly affecting a local refining industry.

## 2.2 VEHICLE STOCK AND CAR OWNERSHIP

It is important to clearly differentiate between indicators of the total vehicle stock and the indicators of the *new* vehicles entering the market. In this section, as background, an

---

<sup>1</sup> This is the case in most countries. But in some countries such as Egypt for example, despite low motorization rates, local air pollutants in its capital Cairo are attributed to the transportation sector with a larger share than industry, or any other sector, also nation-wide energy consumption and fossil fuel consumption is similarly attributed to the transportation sector with a greater share than industry as per Egypt's first national communication for the United Nations Framework Convention for Climate Change.

overview of the total vehicle stock is presented. Due to lack of direct access to official figures, data from the World Bank DataBank (2014) was used to illustrate the trend throughout the years for which data is available, which is sufficient as an indication of trends.

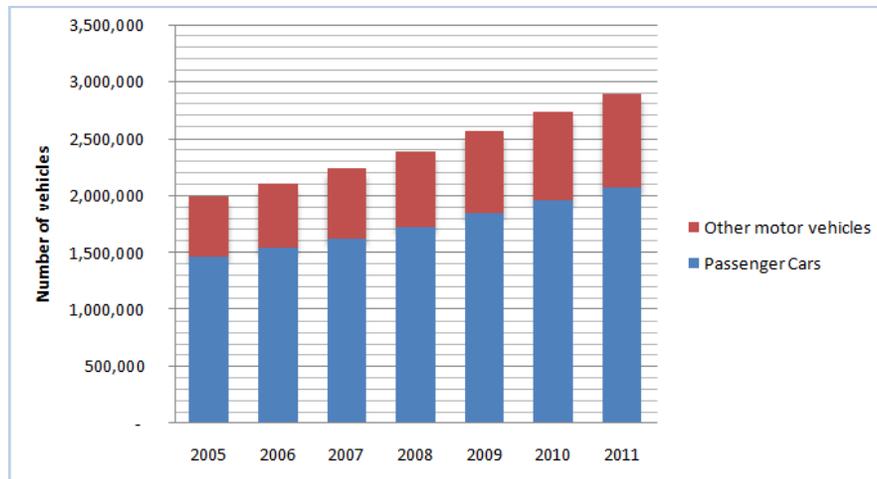


Figure 2: Passenger cars and total motor vehicles in Morocco, 2005-2011 (based on WB Databank data)

Figure 2 shows that passenger cars constitute the majority (72-73%) of vehicle types in the total vehicle stock throughout all years and they grew at an average annual rate of 6%.

Passenger car ownership has likewise grown from 49 cars/1000 inhabitants in 2005 to 65 in 2011. This is an order of magnitude lower than most EU countries, but in a similar range to other countries in North Africa, e.g. 76 in Algeria and 91 in Tunisia in 2011 (WB DataBank, 2014).

It is also expected for a growing developing country that a business-as-usual scenario of rapid vehicle ownership will occur throughout the economic transition as GDP per capita continues to rise (IMF, 2008). Vehicle use is also likely to rise as indicated by increased trends of road-sector fuel consumption and with its plans of expanding road networks (SSWE, 2010).

### 2.3 AUTOMOTIVE INDUSTRY

The automotive industry in Morocco is thriving, providing for both export and to a lesser extent for the domestic market. Morocco has been on a path of market liberalization since 1999. Free trade agreements signed with USA, Turkey, Arab Countries and the European Union (EU) facilitate Morocco's access to the global market and stimulate the local industry (Moroccan Investment Development Agency, 2014).

The automotive sector accounts for a significant share of industrial GDP with more than 130 automotive companies (including about 100 parts manufacturers) employing over 40,000 people (WTO, 2009a). The sector has been identified as one of the key opportunities for growth in its *Plan Emergence* formulated in 2005, and has indeed been a driver of growth for the economy in the recent years (AfDB/OECD, 2007; AfDB/OECD, 2014).

The Moroccan automotive sector consists of assembly of private vehicles and light and heavy goods vehicles as well as subcontracting activity. The assembly work is done by the assembly units of several makers such as DAF, ISUZU, IVECO, MAN, Mercedes, Mitsubishi, Nissan, Renault, Scania and Volvo (WTO, 2009b).

Private and light goods vehicles are assembled by the plants of the Moroccan Automobile Construction Company (SOMACA), which was established in 1960 and later became 80% owned by Renault after privatization in 2003 (Adnan, 2013; WTO, 2009). The SOMACA plants have a production capacity of 60,000 vehicles a year. Furthermore, in 2008, the government of Morocco signed a framework agreement with the Renault-Nissan alliance for the construction of a new production plant near Tangiers with a capacity of 400,000 vehicles/year when all lines are in operation (Renault Tangier-Med Project), 90% of which are destined for export (WTO, 2009; Adnan, S. 2013).

Morocco has improved its competitive position in the global market. As noted earlier, it has achieved a global market share exceeding those of neighbouring countries, Tunisia and Egypt (Office des Changes, 2013).

### 3 REGULATIONS AND POLICY ENVIRONMENT

Since the automotive sector is one of the new pillars of industrial development in Morocco (compared to the earlier traditional industries such as textiles), it is seen by the government as a new growing opportunity for both economic development and job creation. However, despite the novelty of this sector, attention to the environmental aspects has started early on with the government's determination to improve fuel quality over the past years (see section 2.1). Improving fuel quality paves the way to allow practical introduction of cleaner vehicles that optimally operate on cleaner fuels. Other aspects of the regulations and the policy environment affecting the domestic demand are discussed in this section.

#### 3.1 FUEL SUBSIDIES

Diesel is presently subsidized while Gasoline is non-subsidized (GIZ, 2014). It has progressed in this respect significantly faster than other countries in North Africa on that remain subsidized such as Libya, Egypt, Algeria, and (to a lesser extent) Tunisia (GIZ, 2014, IEA, 2014).

Fuel prices have been in steady increase in Morocco. The government is phasing out energy subsidies due to fiscal constraints and has set out a National Energy Strategy since 2009 that includes subsidy reforms as well as other measures for greening and diversification of energy sources (EIA, 2014).

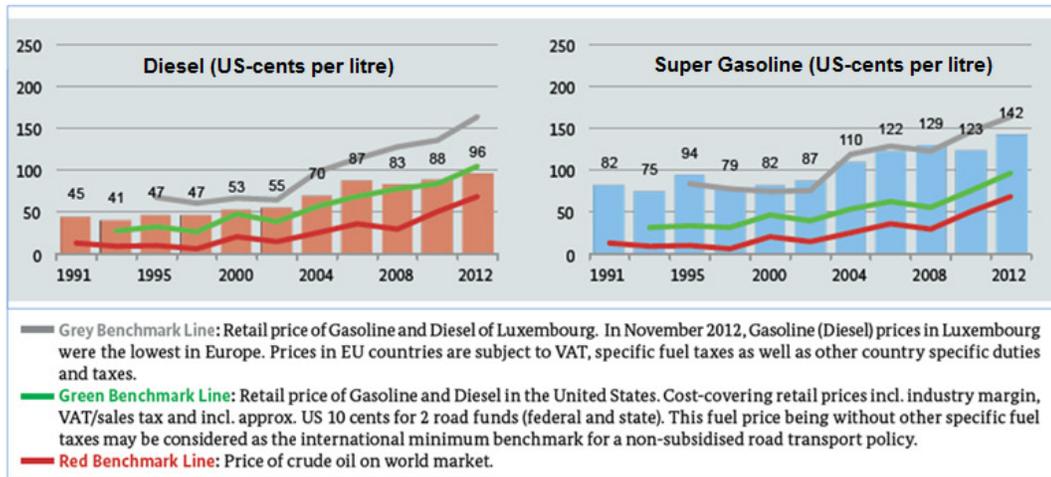


Figure 3: Trends of transportation fuel prices in Morocco in US-cents/liter for diesel and super gasoline respectively (GIZ, 2014)

Figure 3 above shows the gradual increase in fuel prices in Morocco, showing diesel (on the left) and super gasoline (on the right), showing high prices comparable to the US retail price in the case of diesel and comparable to the high EU prices in the case of gasoline.

### 3.2 SOCIAL ASPECTS OF FUEL PRICE HIKES

International experience has consistently shown that fossil fuel subsidies are often disproportionately benefiting the richer strata of society, and should rather be phased out and transferred to targeted support schemes (WB, 2012). In the meantime, the fossil fuel subsidies have been a significant fiscal burden on the government of Morocco. For example, in 2011, the fiscal burden of fossil fuel subsidies in Morocco reached 5.5% of the country's GDP (WB, 2012). In this regard, the government of Morocco reportedly plans to continue to significantly reduce subsidies on diesel fuel to be eventually phased out like gasoline, but will however continue to subsidize wheat, sugar and cooking gas used by poorer segments of society (Reuters, 2014).

### 3.3 CUSTOMS AND TAXATION

In March 2012 custom duties on products imported from EU were fully eliminated (PKF, 2013). Imports from the EU constitute the major share of cars in Morocco. Asian cars and American cars are still subject to considerable import duties.

In Morocco, vehicles are subject to a special annual tax on motor vehicles upon their first registration in Morocco (MEF, 2014). The tax is detailed as follows:

- A fixed fee of 50 dirham (approx. 4.5 Euros) per unit horsepower
- A fixed fee, determined by the fiscal power of the vehicle as shown in Table 1.

Table 1: Taxes by fiscal (taxable) horsepower categories

Taxable Horsepower				
Vehicle Category (taxable horsepower)	< 8	8-10	11-14	>15
Tax*	2,500 DH	4,500 DH	10,000 DH	20,000 DH

\* 1 DH is approx. 0.9 Euros

Furthermore, a proportionate interest in addition to these duties is applicable when submitting the request of the first vehicle registration (made on or after 1 January 2014) and is determined according to the vehicle value as shown in Table 2 (MEF, 2014).

**Table 2: Proportionate interest**

Vehicle Value*	Tax
400,000 - 600,000 DH	5%
600,0001 - 800,000 DH	10%
800,001 – 1,000,000 DH	15%
> 1,000,000 DH	20%

\* 1 DH is approx. 0.9 Euros

With these regulations (registration tax, horsepower tax, and proportionate interest), large and expensive cars pay a disproportionately high fees compared to small and cheap cars. In conclusion, the state of Custom duties favour European cars, and the internal taxation regulations generally favour smaller cars.

## 4 METHODOLOGY

The methodology used was in principle based on the Global Fuel Economy Initiative (GFEI) methodology provided through the online GFEI toolbox<sup>2</sup>. It is used to harmonize global efforts in constructing baselines and identifying trends of national fuel economy and CO<sub>2</sub> emissions of light-duty vehicles (LDVs). LDVs include mini, small, compact, family and big cars, in addition to light vans and sport utility vehicles (SUVs) (Annex 1). The new LDVs data are compiled from sales data from manufacturers. A sample of the data set is presented in Annex 2. The data set includes the following vehicle characteristics:

- Vehicle make
- Vehicle model and type
- Model production year
- Engine size (in cubic centimetres, cc)
- Fuel type
- Sales per vehicle model and fuel type

Based on the available data, the fuel economy figures were obtained for each vehicle as available from manufacturers and normalized to the New European Driving Cycle (NEDC) where necessary so that they are all comparable using the conversion tool of the International Council on Clean Transport (ICCT)<sup>3</sup>. Manufacturers' specifications manual and compilations of the French Environment and Energy Management Agency (ADEME) have been used to assign the best available fuel economy and CO<sub>2</sub> emissions figures for each LDV model<sup>4</sup>.

The years for which sales data was available were limited, and did not include the originally planned baseline year of 2005. The sales data that were retrievable and used in this study were 2009, 2010, and 2013, through automotive markets consultant Matthias Gasnier.

The vehicle models for which fuel economy and emission rate figures could not be found constituted approximately 17% of all sales. The study has therefore covered 83% of all new LDVs sales in the study years. Promotion of stakeholder participation in the future may ensure further completeness of subsequent studies on the topic as discussed in the conclusions section.

Further data from the Moroccan Association for automotives, namely, Association Marocaine pour l'Industrie et le Commerce de l'Automobile (AMICA), could not be

---

<sup>2</sup> GFEI toolbox: <http://www.unep.org/transport/gfei/autotool/about.asp>

<sup>3</sup> ICCT conversion tool: [http://www.theicct.org/info/data/GlobalStdReview\\_Conversionfactor.xlsx](http://www.theicct.org/info/data/GlobalStdReview_Conversionfactor.xlsx)

<sup>4</sup> ADEME's online resource for data on fuel economy and energy emissions of new cars: <http://carlabelling.ademe.fr/>

obtained throughout the study period, but they have been informed about the study in order to encourage interest in subsequent studies in the future as they are a key stakeholder, and similar communication has been conducted with the relevant public authorities in Morocco through the League of Arab States<sup>5,6</sup>.

---

<sup>5</sup> Association Marocaine pour l'Industrie et le Commerce de l'Automobile (AMICA) : <http://www.amica.org.ma/>

<sup>6</sup> Formal written communication through LAS was conducted to inform relevant authorities about the study and request cooperation, as well as the presentation of interim results of the case study in the League of Arab States at a regional forum of the Council of Arab States Responsible for the Environment (CAMRE) titled '*Promoting Better Vehicular Fuel Quality and Fuel Economy Policies for the Arab Region*', 24-25/11/2014, Cairo.

## 5 RESULTS AND DISCUSSION

Figure 4 shows fuel economy (l/100km) trends for new LDVs in Morocco for the years 2009, 2012, and 2013. The trends charted include the trend of gasoline vehicles, diesel vehicles, and the weighted average of both (based on the respective sales figures), to indicate the annual average of all new LDVs.

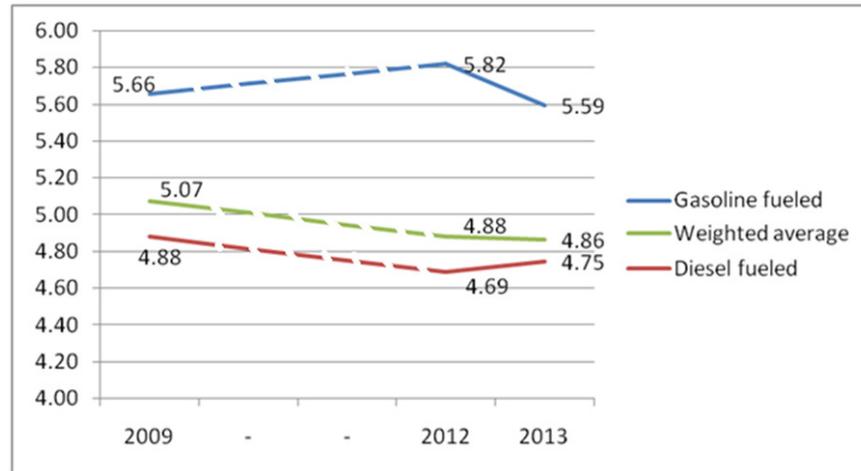


Figure 4: Average Fuel Economy of new LDVs (l/100km) in Morocco in recent years

Since the majority of new LDVs have always been diesel vehicles, the weighted average fuel economy is closer to that of Diesel fueled LDVs.

The top-selling 10 models alone represented 58% of the total sales of 59 models in 2013 as shown in Table 3. The total sales are predominantly of the diesel-version of the models, and the most common engine size of those is the moderate size of 1500cc.

Table 3: Top 10 LDV models in 2013 in Morocco

Ranking	Make	Model	Gasoline		Diesel		Total Sales
			Engine Size	Sales	Engine Size	Sales	
1	DACIA	Logan	1400	536	1500	10170	10706
2	RENAULT	KANGOO	-	-	1500	7249	7249
3	DACIA	Dokker	-	-	1500	6855	6855
4	DACIA	Sandero	1400	1010	1500	5717	6727
6	RENAULT	Clio	1200	1125	1500	4500	5625
5	DACIA	Duster	1600	274	1500	5187	5461
7	FORD	Fiesta	1250	437	1500	3933	4370
8	FIAT	Doblo	-	-	1300	3764	3764
9	FORD	Focus	1600	860	1600	2578	3438
10	PEUGEOT	301	1200	63	1600	2578	2641

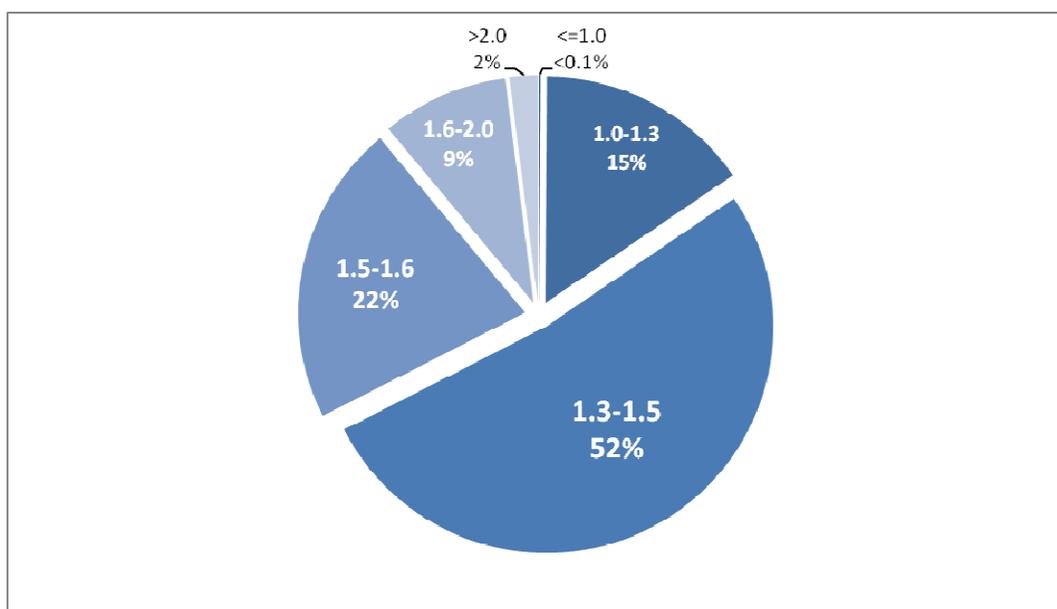
Medium to small sized LDVs is the common choice among consumers in Morocco possibly attributed to the modest income levels per capita and the high gasoline and diesel prices among other factors as explained in the following sections.

Table 4 shows the trend of CO<sub>2</sub> emissions of new LDVs in Morocco for the years 2009, 2012 and 2013 calculated according to the GFEI methodology.

**Table 4: Average annual CO<sub>2</sub> emission rate (gCO<sub>2</sub>/km) of new LDVs in Morocco**

Year	2009	2012	2013
Gasoline LDVs	134.3	134.3	130.3
Diesel LDVs	133.6	125.0	125.2
Weighted average	135.4	126.6	125.9

It is also notable that only a small portion of LDVs sold are of larger engine sizes of 1.6 liters or more. In 2013, the portion was only 11%, whereas the vast majority, 89%, was 1.6 liters or less. Furthermore, if observing gasoline-fuelled LDVs separately, none of them exceed 1.6 liters in capacity (all is equal or less than 1.6 liters).



**Figure 5: Distribution of engine sizes (liters) of new LDVs in Morocco in 2013**

The dominance of medium and small engine sizes shows the inclination of the market in general toward low-consumption LDVs, possibly in anticipation of fuel savings and due to their lower prices in general, given the modest GDP per capita in Morocco compared to richer Arab countries such as Bahrain, Kuwait, or Qatar.

## 5.1 AVERAGE ANNUAL FUEL ECONOMY IN GLOBAL CONTEXT

To put the study results into perspective, Table 5 compares the figures of Morocco with OECD and non-OECD country averages as well as the global average.

**Table 5: Annual average fuel economy of new LDVs in context (units: l/100km, based on NEDC driving cycle)**

	2005	2008	2009	2012	2013	2030
<b>GFEI<sup>a</sup></b>	<b>8.07</b>					<b>4.03 (global target)</b>
<b>Global<sup>a</sup></b>	8.07	7.67				
<b>OECD<sup>a</sup></b>	8.21	7.66				
<b>Non-OECD<sup>a</sup></b>	7.49	7.68				
<b>Morocco</b>			5.07	4.88	4.86	

a: Source: GFEI (2013)

Table 5 shows that the average fuel economy for new LDVs in Morocco at around 5 l/100km in recent years is already 40% less than the global baseline of 8 l/100km in 2005. If the global trend follows the trajectories suggested by GFEI (2.7% annual decrease), then the global average will reach 5 l/100km by 2022. Morocco is therefore among the countries likely to achieve and even exceed the GFEI targets of 2030.

With regards to the average emission rate as well (Table 4, p.16), this average figure reflects a relatively high standard in the global context since it already conforms with the EU targets of phasing-in an average emissions rate of new cars of 130 g/km (5.6l/km) by 2015 (GFEI, 2014).

However, further studies on the total stock of vehicles in Morocco must be conducted to see if the 2050 global target of GFEI for *all* cars is also easily achievable in Morocco.

## 6 CONCLUSIONS

It is clear that Morocco is in a good position with regards to the environmental state of LDVs for two main reasons: the quality of new LDVs is substantially good in comparison with the average global state (as indicated in the comparison in Table 5, p.17), and secondly, despite having LDVs highly dependent on diesel fuel, the quality of diesel fuel is relatively high, having a sulphur content of 50ppm conforming to Euro 4 standards. The regulatory environment is also favouring European cars and cars of smaller sizes/low horsepower (as indicated in section 3.3, p.11). However, despite having a low average annual fuel economy of less than 5 l/100km for new LDVs in recent years, the total vehicle stock is in steady increase as the economy and GDP/capita continue to grow. Some market analysis even expects accelerated growth in sales of up to 8.3% in 2015 (BMI, 2014). The study of fuel consumption and emissions in absolute terms is therefore important from an environmental perspective, including the entire stock of LDVs. This is the recommended next step to the present study in order to better understand the state of motorized vehicles in Morocco and their impact on the environment as car ownership and fuel consumption increase. Ideally, these increases should not offset the benefits brought by the new cleaner vehicles.

In comparison with all other countries in North Africa, namely Algeria, Libya, Tunisia, and Egypt, the fuel prices in Morocco are significantly higher, and planned to continue to increase as subsidies are further removed from diesel fuel. This might be a key contributor to shaping the market demand, which is inclined toward low-consumption vehicles.

### 6.1 MONITORING, EVALUATION AND INFORMATION EXCHANGE

Throughout the study period, obtaining information about LDVs in Morocco has been a difficult task, and little literature about the topic is available in publications. It is recommended to expose the case of LDVs in Morocco as a good-practice example from a developing country in order to offer lessons learnt for other countries in the Arab region. The average emission and fuel economy of new LDVs already conforms to the EU 2015 targets, and it is also important for the decision makers in Morocco to understand this comparative advantage in order to maintain and safeguard the policy environment that favours efficient vehicles.

Part of the monitoring, evaluation and information exchange can be the encouragement of industry reporting (whether compulsory or voluntary), such as already conducted in numerous developing countries including India, Brazil, Philippines, and Turkey<sup>7</sup>.

Furthermore, an economy in transition such as Morocco, with a significantly low car ownership rate compared to EU countries, is expected to experience significant change as the typical ownership trajectory takes its course in tandem with growing GDP per capita. Therefore, continuous monitoring and evaluation of the quality of this growth is very

---

<sup>7</sup> For case studies on various regulations, see: [http://www.unep.org/transport/gfei/autotool/nextsteps/case\\_study\\_at\\_a\\_glance.asp](http://www.unep.org/transport/gfei/autotool/nextsteps/case_study_at_a_glance.asp)

important, and a mechanism for such monitoring and evaluation should advisably be put in place and include the entire vehicles stock. Monitoring and evaluation of the extent of *use* of the vehicle stock as well is recommended, since fuel consumption is in continuous growth and fuel supply is almost entirely dependent on import, while road networks are in continuous expansion. This poses a significant risk to the energy security of the import-dependent country and requires proactive planning. It is important for decision makers to be informed about such risks, but also to realize and leverage the relative advantage of this young sector in Morocco at its early stage and to see the opportunities to leapfrog into a paradigm of sustainability rather than repeating the traditional vehicle ownership trajectory.

## 6.2 FUTURE STUDIES

The scope of this study has been limited to *new* LDVs. A gap of information still exists with regards to the entire vehicle stock and the consumption trends, as well as the end-of-life vehicles. In order to have a better understanding of the impact of LDVs on carbon emissions and energy resources, it is recommended to proceed to the next step of this study and investigate the state of the entire vehicles stock and identify the opportunities to effectively manage stocks and flows of vehicles and fuels and to ensure sustainability of the sector based on reliable information about it and stakeholder involvement.

## 7 REFERENCES

1. Adnan, S. (2013): *Moroccan Automotive Industry: opportunities and perspectives*. Presentation by Moroccan Association for Automotive Industry and Trade (AMICA). Retrieved from: <http://www.equipauto.com/content/download/117360/1290451/file/Focus%20Morocco.pdf>
2. African Development Bank (AfDB) (2012): *Unlocking North Africa's Potential through Regional Integration: Challenges and Opportunities*. Retrieved from: <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Unlocking%20North%20Africa%20RI%20ENG%20FINAL.pdf>
3. African Development Bank (AfDB) (2012): *Unlocking North Africa's Potential through Regional Integration: Challenges and Opportunities*. Retrieved from: <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Unlocking%20North%20Africa%20RI%20ENG%20FINAL.pdf>
4. Business Monitor International (2014): *Morocco Autos Report Q1 2015*. Retrieved from: <http://www.marketresearch.com/Business-Monitor-International-v304/Morocco-Autos-Q1-8592351/>
5. Centre for Environment and Development in the Arab Region and Europe (CEDARE) (2010): *Middle East Cleaner Fuels & Vehicles For Clean Air Policy Forum, 2010 Forum Report*. Retrieved from: [http://www.unep.org/transport/pcf/PDF/Cairopolicy\\_workshopreport.pdf](http://www.unep.org/transport/pcf/PDF/Cairopolicy_workshopreport.pdf)
6. EL-Oualja, Hafid (2010): *Combustible Fuels and Clean Transport Modes in Morocco*. Presentation in Middle East Cleaner Fuels & Vehicles For Clean Air Policy Forum, 26-27 September, 2010, Cairo (in Arabic). Retrieved from: [http://www.unep.org/transport/pcf/PDF/Cairo\\_StatusofCountries\\_MoroccoCaseStudy.ppt](http://www.unep.org/transport/pcf/PDF/Cairo_StatusofCountries_MoroccoCaseStudy.ppt)
7. Ernst & Young (2011). *Doing Business in Morocco*. Available at: <http://emergingmarkets.ey.com/wp-content/uploads/downloads/2012/05/Doing-Business-in-Morocco-2011.pdf>
8. Exchange Office (2013): *L'industrie automobile au Maroc -Performance à l'export-* (in French). Exchange office, Kingdom of Morocco.
9. Global Fuel Economy Initiative (2013): *Global Fuel Economy Initiative: Plan of Action 2012-2015*. Retrieved from: <http://www.globalfueleconomy.org/Documents/Publications/workplan.pdf>

10. International Energy Agency (2014). IEA review of Morocco's energy policies highlights country's progress towards energy transition. Retrieved from: <http://www.iea.org/newsroomandevents/pressreleases/2014/october/review-highlights-moroccos-progress-towards-energy-transition.html>
11. International Monetary Fund (2008). Chapter 4: Climate Change and the Global Fuel Economy, *World Economic Outlook 2008*. Retrieved from: <http://www.imf.org/external/pubs/ft/weo/2008/01/pdf/c4.pdf>
12. Ministère de l'Économie et de Finances (2014): Note Circulaire N° 722 Relative aux Dispositions Fiscales de la Loi de Finances N° 110-13 pour l'Année Budgétaire 2014. Direction Générale des Impôts. Retrieved from : [http://www.finances.gov.ma/Docs/2014/DGI/nc\\_%20722\\_lf\\_2014.pdf](http://www.finances.gov.ma/Docs/2014/DGI/nc_%20722_lf_2014.pdf)
13. Morocco Investment Development Agency (2014): *Free Trade Agreements*. Retrieved from: <http://www.invest.gov.ma/?id=77&lang=en>
14. OECD/AfDB (2008): *Morocco*. African Economic Outlook. Retrieved from: <http://www.oecd.org/dev/emea/40578273.pdf>
15. OECD/AfDB (2014): *Morocco*. African Economic Outlook. Retrieved from: [http://www.africaneconomicoutlook.org/fileadmin/uploads/aeo/2014/PDF/CN\\_Long\\_EN/Maroc\\_EN.pdf](http://www.africaneconomicoutlook.org/fileadmin/uploads/aeo/2014/PDF/CN_Long_EN/Maroc_EN.pdf)
16. Office des Changes (2013): L'industrie automobile au Maroc -Performance à l'export- (in French). Office des Change, Kingdom of Morocco.
17. The International Organization of Motor Vehicle Manufacturers (OICA). Total in Use 2012. Available at: <http://www.oica.net/category/about-us/>. Accessed: September 4<sup>th</sup>, 2014.
18. PKF International (2013). *Morocco Tax Guide 2013*. United Kingdom: PKF International Limited. Retrieved from: <http://www.pkf.com/media/1960379/morocco%20pkf%20tax%20guide%202013.pdf>
19. Reuters (2014): Morocco ends gasoline, fuel oil subsidies. January 17, 2014. Retrieved from: <http://www.reuters.com/article/2014/01/17/morocco-economy-subsidies-idUSL5N0KR2EV20140117>
20. Secretary of State for Water and Environment (2010): *Seconde Communication Nationale a la Convention Cadre des Nations Unies sur les Changements Climatiques*, Secretary of State for Water and Environment, Kingdom of Morocco. Retrieved from: <http://unfccc.int/resource/docs/natc/mornc2f.pdf>

21. United Nations Economic Commission for Africa (UNECA)/United Nations Economic Commission for Europe (UNECE) (2014): *Maroc: Examen des performances environnementales*, Retrieved from :  
[http://www.unece.org/fileadmin/DAM/env/epr/epr\\_studies/ECE\\_CEP\\_170\\_FRE.pdf](http://www.unece.org/fileadmin/DAM/env/epr/epr_studies/ECE_CEP_170_FRE.pdf)
22. Van Breusegem,W. and Soulami, M. (2011): *Analysis for European Neighbourhood Policy (ENP) Countries and the Russian Federation of social and economic benefits of enhanced Environment Protection – Morocco Country Report*, funded by the European Commission. Brussels. Retrieved from: <http://www.enpi-info.eu/library/sites/default/files/attachments/Morocco-ENPI%20Benefit%20Assess.pdf>
23. World Bank (2012): *The Real Costs of Fossil Fuel Subsidies*. Retrieved from: <http://www.worldbank.org/en/news/feature/2012/05/09/real-costs-fossil-fuel-subsidies>
24. World Bank (2014): Country and Lending Groups. Retrieved from: <http://data.worldbank.org/about/country-and-lending-groups>
25. World DataBank (2014): *World Development Indicators*, retrieved from: <http://databank.worldbank.org> , accessed: January 20th , 2014.
26. WTO (2009a): *Trade policies by measure*, Trade policy review: Morocco. Retrieved from: [http://www.wto.org/english/tratop\\_e/tpr\\_e/s217-03\\_e.doc](http://www.wto.org/english/tratop_e/tpr_e/s217-03_e.doc)
27. WTO (2009b): *Trade policies by sector*, Trade policy review: Morocco. Retrieved from: [http://www.wto.org/english/tratop\\_e/tpr\\_e/s217-04\\_e.doc](http://www.wto.org/english/tratop_e/tpr_e/s217-04_e.doc)

**ANNEX-1: GFEI CLASSIFICATION OF LDVS**

<b>Vehicle Segment</b>	<b>Examples</b>
<b>A: Mini / Micro / Small town car</b> <i>Smallest cars, with a length between 2.50m to 3.60m.</i>	Citroën C1 Fiat Panda Smart Fortwo
<b>B: Small compact</b> <i>Slightly more powerful than the Minis; still primarily for urban use; length between 3.60m and 4.05m</i>	Mitsubishi Colt Opel Corsa Suzuki Swift
<b>C: Compact</b> <i>Length between 4.05m – 4.50m</i>	Mazda 3 Subaru Impreza Volvo S40
<b>D: Family cars</b> <i>Designed for longer distance; fits 5- 6 people; length is 4.50m to 4.80m</i>	BMW 3 series Chrysler Sebring Lexus IS
<b>Light vans</b> <i>Size is similar to D, but interior volume is maximized to accommodate larger families</i>	Chevrolet Uplander Ford Galaxy Volkswagen Sharan
<b>Big / Full size cars</b> <i>Have generous leg room; can comfortably transport 5 - 6 people; generally have V8 engines and are 5m or longer in length</i>	Cadillac DTS Jaguar XJ Mercedes-Benz E Class
<b>SUV / All terrain</b> <i>The original cars were utility cross-country vehicles with integral transmissions like the Jeep</i>	Dodge Durango Jeep Grand Cherokee Nissan Patrol Toyota Land Cruiser

**ANNEX-2: SAMPLE OF LDV DATA**

Make	Model	Engine Size (cubic centimeters)	Fuel Type	Sales	Fuel Economy (Liter/ 100 km)	CO2 emissions
CITROEN	Berlingo	1600	diesel	2282	5.3	139
CITROEN	Nemo	1400	diesel	443	4.5	119
CITROEN	C-Elysee	1600	diesel	929	4.3	112
CITROEN	C3	1600	diesel	534	4.2	109
CITROEN	C4	1600	diesel	857	4.2	110
CITROEN	DS4	1600	diesel	26	4.4	115
DACIA	Dokker	1500	diesel	6855	5.2	139
DACIA	Duster	1500	diesel	5187	5	139
DACIA	Logan	1500	diesel	10170	3.8	119
DACIA	Sandero	1500	diesel	5717	4.5	120
FIAT	Doblo	1300	diesel	3764	7.4	137
FORD	Transit	1800	diesel	830	6.6	172
FORD	Fiesta	1500	diesel	3933	3.7	98
CITROEN	C-Elysee	1200	Gasoline	105	5.3	115
CITROEN	C1	1000	Gasoline	88	4.6	108
CITROEN	C3	1200	Gasoline	60	3.5	99
Dacia	Duster	1600	Gasoline	274	8	185
DACIA	Logan	1400	Gasoline	536	7.8	165
DACIA	Sandero	1400	Gasoline	1010	7	165
FIAT	Punto	1200	Gasoline	1714	5.2	126
FORD	Fiesta	1250	Gasoline	437	5.6	129
FORD	Focus	1600	Gasoline	860	6	139
HYUNDAI	i10	1100	Gasoline	2595	4.7	108
HYUNDAI	i30	1400	Gasoline	59	6.1	142