REGIONAL ENVIRONMENTAL CENTER

# IMPROVING AUTO FUEL ECONOMY IN THE REPUBLIC OF MACEDONIA

# CONTENTS

# Acknowledgements

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The full policy version can be accessed at:

http://www.mk.rec.org/news-item-eng.php?id=2523

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[1]GFEI is a partnership of the International Energy Agency (IEA), United Nations Environment Programme (UNEP), International Transport Forum of the OECD (ITF), International Council on Clean Transportation (ICCT), Institute for Transportation Studies at UC Davis, and the FIA Foundation.

# Introduction

In order for the world to stay within the safety threshold of a 2°C increase in average temperature the transport sector needs to be decarbonized. Therefore, curbing road vehicle population growth, reducing travel demand and improving vehicle fuel efficiency are three key elements needed to improve the global fuel economy by reducing the overall oil demand and GHG emissions.

REC Country Office Macedonia (REC COM) is implementing the project "Stabilizing greenhouse gas emissions from road transport trough doubling of global vehicle fuel economy: regional implementation of the global initiative for fuel economy", under the United Nations Environment Programme (UNEP).

The ultimate goal of the Project is to develop, jointly with relevant stakeholders, a National Fuel Economy Policy Paper, to publicize policy measures with the general public and to submit the Policy Paper to the Macedonian Government for adoption. The Policy Paper comprises proposals for the improvement of the data records of registered vehicles to also include the $CO_2$ emissions declared by the manufacturer and share the data with relevant stakeholders, a comprehensive set of policy reforms in the vehicle tax schemes and a strategy for "greening" the vehicle fleet.

# Issues in passenger transport

*Currently, the FYR of Macedonia lacks a comprehensive strategy for improving the fuel economy in the national car fleet. The existing situation is caused by gaps at the policy and institutional levels, particularly the:*

**1** Non-existence of a strategy with a clear vision of how to improve the situation in the on-road transport sector.

**2** Fragmented and inconsistent transport policies and strategies.

**3** No fiscal policy incentives to increase fuel efficiency and lower pollutant emissions from imported vehicles.

**4** Lack of a centralized management in the transport sector and inefficient communication between governmental institutions responsible for managing the sector.

This results in the following challenges:

- Dramatic increase in number of passenger vehicles: The national vehicle fleet has increased its size for more than 30% between 2005 and 2013.

- Very old passenger vehicle fleet: In 2013, 90% of the first registration vehicles have been used vehicles, from which 74% have been older than 11 years, compared to 2008 when 70% have been new vehicles. The average age of the whole national vehicle fleet has been steadily increasing from 15.8 in 2005, 17.2 in 2013 to 18.7 in 2017.

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- Worsening fuel economy of passenger vehicles: In the period of 2005-2008, vehicles with better fuel economy have been increasing their share in the total first registration vehicle fleet. However, this trend reversed, and the average fuel economy of first registration vehicles worsened from 6.5 lge/100 km in 2008 to 6.9 lge/100 km in 2013.

- Dramatic increase of diesel passenger vehicles: From 2005 to 2013 the first registration vehicles that used petrol as fuel has decreased their share to 25%, and vehicles that used diesel as fuel have increased their share to 75%.

- Carbon dioxide emissions increase from passenger vehicles: In 2013 the average $CO_2$ emissions from first registration vehicles increased back to 2005 level of 160 $CO_2$ g/km, most probably due to the 2010 removal of import restrictions on vehicle exhaust standards.

- The old passenger vehicle fleet is concentrated in the major cities of the FYR of Macedonia, and causes increased local air pollution, especially in winter periods.

Additionally, a necessary pre-requisite for gaining reliable data for the fuel economy baseline and the national fleet's $CO_2$ emissions, is a maintained database. Until now, no national institution that currently has a database of imported (Customs Administration) and registered (MoI, Bureau of Metrology, Ministry of Transport and Communications) vehicles, includes $CO_2$ vehicle emissions data in its register. However, in line with EU Directive 443/2009/EC, each of the EU countries needs to report on each new registered passenger vehicle, which prioritizes the need for establishing a $CO_2$ vehicle emissions database. Additionally, this register would enable monitoring and evaluating the effectiveness of the Policy measures for reducing national $CO_2$ emissions of the transport sector.

# Fuel Economy Policy Benefits



*Improving fuel economy of vehicles is important for at least five reasons:*

- money saving,
- reducing negative climate change effects
- reducing air pollution and noise
- reducing national dependency on oil
- increasing energy stability.

Fuel Economy, fuel efficiency or fuel consumption of a certain vehicle is the ratio of distance travelled per unit of fuel consumed (ex. km/L) or fuel consumption per travelled distance (L/100 km). Thus, the greater the distance travelled per unit of fuel, the greater the fuel economy/efficiency.

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The less energy consumed to travel a certain distance, the more efficient the vehicle is. Improved fuel economy is cost-efficient as:

- 30% fuel consumption reduction pays back after 3.5 years (44,000 km, USD 1.1/L, 8L/100km base FE, no discounting, today's technology cost)

- 50% fuel consumption reduction pays back after 6 years (75,000 km, USD 1.1/L, 8L/100km base FE, no discounting).[2]

The need for developing a targeted national fuel economy policy and its adoption though recommended financial instruments and supporting measures will generate benefits (Figure 1) to:

- *The environment* though improving local air quality and decreasing the carbon footprint from the transport sector;

- *The financial sector* through reducing government and consumer expenditure on oil;

- *The energy sector* through saving energy from reducing energy consumption;

- *The car manufacturing sector* through harmonization of safety and emissions regulations that alleviate compliance for car manufacturers.

[2] *IEA Technology Roadmap: Fuel Economy of Road Vehicles*
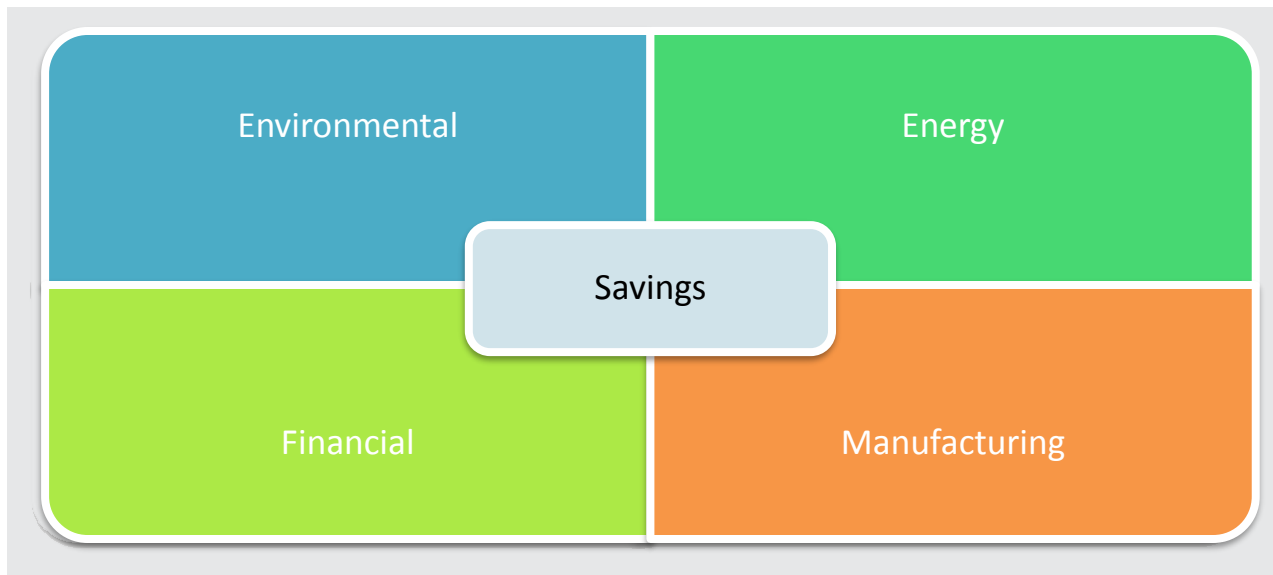
*Figure 1 Automotive fuel economy policy benefits*

# Fuel Economy Policy Aim

It is hoped that this Policy and the many examples, experiences and practices contained in it, will support legal practitioners and policy makers in making well-informed decisions when drafting, implementing or aiming to improve their policies, strategies and action plans related to improving local air quality and reducing climate change impacts from the transport sector.

The overall aim of FEP is to facilitate an improvement in average fuel economy (reduction in fuel consumption per kilometre) of the current and future vehicle fleet, which would accrue large reductions of greenhouse gas emissions, oil use and urban air pollution through the promotion of cleaner and more fuel-efficient vehicles. The core policy strategy for reducing greenhouse gas emissions from road transportation is to incentivize the purchase of motor vehicles with relatively no or low tailpipe $CO_2$ emissions, as well as to facilitate the implementation of EU standards for fuel and clean vehicle technologies.

*As it is impractical and costly to entirely convert the efficiency of existing vehicle fleet, and vehicle stocks usually turn over only every 10 to 15 years, the fuel economy policy should focus both on improving the efficiency of the new entrants to the vehicle stock and incentivize replacement of inefficient vehicles.*

## The FEP's aim is to address this issue through the following different approaches:

| 1 | 2 | 3 |
|---|---|---|
| Vehicle fuel economy and $CO_2$ emission standards; | Fiscal measures such as vehicle taxes, $CO_2$ taxes; | Zero-emission vehicles subsidies; |

| 4 | 5 |
|---|---|
| Information measures such as fuel economy and/or $CO_2$ emissions labelling; and | Other soft measures; |

The combined force of introducing standards, subsidizing, differentiating taxation by fuel economy, and information sharing is to stimulate the outcomes:

The national proposed fuel economy target is 4.61 lge/100 km or 112.6 grams of g $CO_2$/km 2025. This represents a 30% improvement from the base year of 2013 when the average fuel economy of first registration vehicles amounted to 6.90 lge/100 km. The proposed target is realistic and is aligned towards the Global Fuel Economy Initiative (GFEI) target of global average 4.2 lge/100 km or average of 100 grams of g $CO_2$/km.

# Proposed measures



## 6.1    *Vehicle taxes reform*

Consumers have been found to be more responsive to upfront taxes as purchasing decisions are more sensitive to upfront prices and taxes than to the expected lifetime costs of the car. Therefore, this Policy proposes reforming the current environmental fee paid at annual vehicle registrations and the excise tax for imported vehicles to include $CO_2$ emissions as criterion in the calculation methodology of the taxes. This $CO_2$ taxation could potentially influence the purchase of cleaner vehicles.

## 6.2 New methodology for calculation of vehicle taxation (excise) during import

This Policy proposes reforming the current excise tax for imported vehicles into $CO_2$ vehicle tax. The proposed methodology for calculation of this tax for passenger vehicles during import favorizes **vehicles with higher fuel economy,** which to a certain degree would pay less compared to the current excise, resulting from their lower $CO_2$ emissions.

In continuation the new proposal for calculation of the tax (excise) of the vehicles during import is shown, comprised of two portions: the vehicle value and $CO_2$ emissions, represented in a form of a formula as follows:

$$excise = V * ƒv + CO_2 * ƒco_2$$

where:

$V$ – vehicle value

$ƒ_v$ – percentage read from Table 1, corresponding with the relevant vehicle value,

$CO_2$ - $CO_2$ emissions for the relevant vehicle,

$ƒco_2$ - coefficient read from Table 2**Error! Reference source not found.**, corresponding with the relevant vehicle $CO_2$ emissions value.

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The vehicle value corresponds with a relevant percentage from Table 1. This part of the equation is similar to the current modality of calculation of the excise, yet is different as a certain tax is also charged on vehicles worth less than 13,000 EUR. The difference between the current modality of calculation of the excise and the new proposed percentages can be best seen as on Table 1**Error! Reference source not found.**. The vehicles worth below 13,000 EUR according to the current modality of calculation of the excise are charged 4% of the vehicle value, while according to the newly proposed solution would require only 1% of the vehicle value.

| Passenger vehicle value in EUR | Excise rate |
|---|---|
| 0 - 3000 | 0,00 % |
| 3000 - 4000 | 0,50 % |
| 4000 - 5000 | 1,00 % |
| 5000 - 6000 | 1,50 % |
| 6000 - 8500 | 2,00 % |
| 8500 - 12000 | 3,00 % |
| 12000 - 14000 | 4,00 % |
| 14000 - 16000 | 6,00 % |
| 16000 - 18000 | 9,00 % |
| 18000 - 22000 | 11,50 % |
| 22000 - 25000 | 13,50 % |
| 25000 - 30000 | 15,50 % |
| 30000 | 18,00 % |

*Table 1. Border values and taxation percentages*

| Proposed limiting values Passenger vehicle value in EUR | Proposed percentage |
|---|---|
| 0 - 3000 | 0,00 % |
| 3000 - 4000 | 0,50 % |
| 4000 - 5000 | 1,00 % |
| 5000 - 6000 | 1,50 % |
| 6000 - 8500 | 2,00 % |
| 8500 - 12000 | 3,00 % |
| 12000 - 14000 | 4,00 % |
| 14000 - 16000 | 6,00 % |
| 16000 - 18000 | 9,00 % |
| 18000 - 22000 | 11,50 % |
| 22000 - 25000 | 13,50 % |
| 25000 - 30000 | 15,50 % |
| 30000 | 18,00 % |

Table 2. Border values and taxation percentages

In the proposed formula for calculation of the vehicle taxation are included also the $CO_2$ emissions that the vehicle generates during fuel combustion. Taking examples from other states, specific values for diesel, petrol, LPG and CNG vehicles have been defined. The declared $CO_2$ emissions of the vehicle are multiplied with the coefficient that can be read from Table 2.**Error! Reference source not found.** which depends on the group the vehicle belongs according to the declared emissions. The proposed coefficients are made after long simulations and the same grow with the exponential function as the emissions of $CO_2$ increase. The coefficients for diesel lag for 2 scales behind the coefficients for petrol.

| Border values of $CO_2$ (g $CO_2$/km) | Coefficient (MKD/g $CO_2$/km) | |
|:---:|:---:|:---:|
| From–To | $f_{CO_2}$ - petrol, LPG, CNG | $f_{CO_2}$ - diesel |
| 0 - 0 | 0 | 0 |
| 1 - 65 | 30 | 30 |
| 66 -90 | 45 | 75 |
| 91 - 100 | 60 | 95 |
| 101 - 110 | 75 | 105 |
| 111 - 120 | 95 | 120 |
| 121 - 130 | 105 | 135 |
| 131 - 140 | 120 | 165 |
| 141 - 160 | 135 | 195 |
| 161 - 180 | 165 | 225 |
| 181 - 200 | 195 | 255 |
| 201 - 225 | 225 | 285 |
| 226 - 250 | 255 | 330 |
| 251 - 300 | 285 | 375 |
| 301 | 330 | 420 |

Table 3. Border values and taxation coefficients by CO2

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In addition, the calculations from the proposed methodology for vehicle taxation show that the Customs Administration would receive higher revenues from imported vehicles tax, by approximately 6 million EUR more compared to the actual revenues of 2015.

## 6.1 New methodology for calculation of environmental fee of annual registrations

The second key reform in this Policy is a reform proposal for calculating the environmental fee of annual vehicle registrations. The proposal covers a new methodology that includes the level of $CO_2$ vehicle emissions and other pollutants, using vehicle age as main calculation criteria. For vehicles with no reliable $CO_2$ data certificate available, the fee will be calculated based on engine power, but these vehicles would pay a higher fee than vehicles for which reliable $CO_2$ emissions data may be given.

(1) The amount of the annual environmental fee for registration of motor vehicles or watercrafts is calculated with a quotient K, which value is 2% from the basic insurance of a vehicle with engine power of 40 kW, and according to:

1) The $CO_2$ emissions: For vehicles for which the $CO_2$ emission level can be credibly verified (declared by the manufacturer):

| No. | $CO_2$ emissions (g/km) | Fee | |
|---|---|---|---|
| | | Petrol | Diesel |
| 1 | below 115 | K | 1.2 K |
| 2 | from 115 to 130 | 1.1 K | 1.3 K |
| 3 | from 130 to 145 | 1.2 K | 1.4 K |
| 4 | from 145 to 160 | 1.3 K | 1.5 K |
| 5 | from 160 to 175 | 1.4 K | 1.6 K |
| 6 | from 175 to 190 | 1.5 K | 1.7 K |
| 7 | from 190 to 205 | 1.7 K | 1.9 K |
| 8 | from 205 to 220 | 2 K | 2.2 K |
| 9 | from 220 to 235 | 2.3 K | 2.5 K |
| 10 | above 235 | 2.6 K | 2.8 K |

- For vehicles aging from 5 to 10 years, the table from the first bullet point of point 1) to be referred to, increased for 20% for every year above 5 years of age;

- For vehicles aged above 10 years, the table from the first bullet point of point 1) to be referred to, increased for 40% for every year above 10 years of age.

2)  Engine power for vehicles for which the $CO_2$ emission level cannot be credibly verified (declared by the manufacturer) -
-        For new vehicles and vehicles not older than 5 years, the following table to be referred to:

| No. | Engine power (g/km) | Fee (petrol) | (diesel) |
|---|---|---|---|
| 1 | From 22 kW | 1.2 K | 1.4 K |
| 2 | From 23 to 33 | 1.4 K | 1.6 K |
| 3 | From 34 to 44 | 1.6 K | 1.8 K |
| 4 | From 45 to 55 | 1.8 K | 2 K |
| 5 | From 56 to 66 | 2 K | 2.2 k |
| 6 | From 67 to 84 | 2.2 K | 2.4 K |
| 7 | From 85 to 100 | 2.4 K | 2.6 K |
| 8 | From 101 to 150 | 2.6 K | 2.8 K |
| 9 | Over 150 | 2.8 K | 3 k |
| 10 | SG shape | 2.8 K | 3 k |

- For vehicles aging from 5 to 10 years, the table from the first bullet point of point 2) to be referred to, increased for 20% for every year above 5 years of age;

- For vehicles aged above 10 years, the table from the first bullet point of point 2) to be referred to, increased for 40% for every year above 10 years of age;

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The results indicate that with the current modality of calculation of the environmental fee at annual registration of the vehicles, MKD 42,221,630 have been collected (data from the year 2015). If in the year 2015 the proposal from this policy has been used for calculation of the environmental fee at annual registration of the vehicles, based on $CO_2$ emissions, the age of the vehicle and fuel type, then **MKD 242,582,456** would have been collected, which is by ~83% increased revenue from the actual revenues of 2015 generated from the environmental fee at annual registration of the vehicles.

## 6.2    Survey

In order to collect information from the citizens of the Republic of Macedonia who drive passenger cars, taxi companies and car dealers (distributors of brand-new and used vehicles) on their knowledge of national fuel economy policies and their opinion on subsidies implementation, a survey of 32 questions was conducted on 243 participants, 37 taxi drivers (companies) and 18 car dealerships.

Based on the analysis of the participants' responses, the following general conclusion can be made:

1. Only a small number of participants were familiar with the taxation policies and environmental fees, with the majority of participants not being familiar with the fact that there is an environmental tax included in the fuel price.

2. Citizens were able to allocate an average sum of 5,000 – 13,000 EUR or a minimum monthly installment of 100 EUR, for the purchase of a new hybrid or electric vehicle.

3. According to car dealerships of new vehicles, for a brand-new car, citizens would need to allocate an average sum of 17,500 EUR, while for a used car, citizens would need to allocate an average sum of 4,900 EUR.

4. More than 90% of all participants were willing to buy a hybrid or an electric vehicle, with the condition on introducing subsidies of approximately 5,000 EUR. Of the total number of taxi drivers, 100% supported this idea.

## 6.3  *Subsidies*

These additional revenues from the proposed vehicle taxation reforms of both import and annual vehicle registration fees, could be used for extending the charging infrastructure for electric vehicles across the territory of the FYR of Macedonia and establishing a subsidy program for purchasing „clean" vehicle[3], in order to increase road traffic safety, decrease vehicle maintenance costs for the citizens and directly contribute towards reducing ambient air pollution. In this Policy 3 (three) possible programs for subsidies of clean vehicles have been proposed:

1. Subsidy program for new and electric vehicles – in order to increase public awareness for the purchase of "clean" vehicles with better fuel economy and renewal of the national vehicle fleet. Subventions are estimated in the amount of **3,000 EUR** in MKD counter-value for the purchase of **hybrid vehicles** which **do not surpass 95 gCO$_2$/km** and **5,000 EUR** in MKD counter-value for the purchase of **electric vehicles**.

2. Subsidy program new for old vehicle – in order to remove the old vehicles from the national vehicle fleet and replace them with "clean" vehicles with better fuel economy. It is proposed to give subventions on **20% from the price of the new vehicle**, however **not more than 3,000 EUR** in MKD counter-value. The new vehicle **cannot emit above 95 gCO$_2$/km**. Buying clean vehicles needs to be especially stimulated.

3. Subsidy program for converting vehicles to LPG, methane or other alternative fuels – alternative fuels such as LPG and methane are regarded as cleaner fuels because less particles, carbon dioxide, nitrogen oxides and sulfur dioxides are released on ignition compared to conventional fuels such as oil and petrol. It is estimated to subsidize **50% of the cost** for conversion, however **not more than 250 EUR** in MKD counter-value.

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[3] In this Policy the term „clean" vehicles refers to vehicles with very low carbon dioxide emissions under 50 g CO$_2$/km (~ 2 lge/100 km), mainly hybrid vehicles with plug-ins, equipped with internal ignition engine and electric engine.

## 6.4    *Ecological Vehicle Register*

This policy explains the barriers of availability and access to $CO_2$ emissions data from the passenger transport and proposes a design solution for establishing a separate ecological vehicle register in the Ministry of Environment and Physical Planning, in which data will be transferred directly from the Customs Administration and Technical Stations. In such way, the MoEPP will receive $CO_2$ emissions data other relevant data from passenger transport and in line with EU Directive 443/2009/EC.

In this policy it is proposed that the EVRM is hosted on hardware infrastructure and physically installed in Ministry of Environment and Physical Planning (MoEPP) (Figure 2). This Policy proposes an amendment of the Law on Vehicles (OGRM No. 140/08, 53/11, 123/12, 70/13, 164/13, 138/14, 154/15, 192/15 and 39/16) and Law on Environment (OGRM No. 53/05, 81/05, 27/07, 159/08 and 83/09) by article 73-v, that will enable the establishment of an Ecological Vehicle Register in the MoEPP.

The transposition of the Directive 443/2009/EC in the national legislation does not have a high priority because the state does not have vehicle producers. However, considering the fact that Macedonia will have to notify EU regarding the structure of imported (new) vehicles, the establishment of a database for the fleet and its fuel economy will be good grounds for this reporting to the EU to be enabled in the future.

Ultimately, this system of $CO_2$ data collection and access for analysis, will enable monitoring of the success rate of the measures applied for improving the fuel economy of the national vehicle fleet.
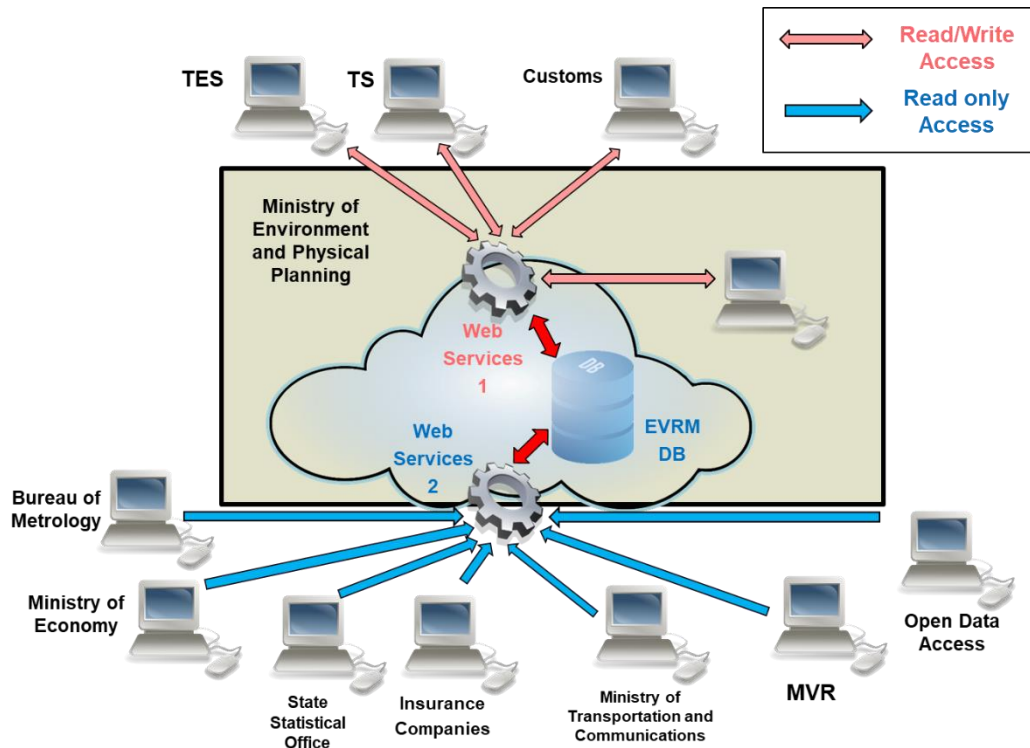
*Figure 2. Proposed architecture of the new Ecological Vehicle Register for FYROM (EVRM) system; TES – Technical Examination Stations; TS - Technical Service; MVR – Ministry of Interior Affairs*

## 6.5    *Fuel Economy Label*

The fuel economy label has not been yet implemented fully. This instrument offers great potential for influencing byer's decision making when purchasing a vehicle. Based on the gap analyses of the current fuel economy label regulation, it is recommended that the label should be designed on a white background, in accordance with the Directive 1999/94/EC, therefore a standard national label template is necessary to be designed and visibly displayed at the point of vehicle sale or lease. Moreover, it is recommended that official penalties for breaching this regulation are needed to be adopted in the relevant national legislation.

It is advisable to design a label with a metric comparing fuel costs spent or saved over five years compared to the average new vehicle now. Moreover, people are more likely to prefer the fuel-efficient car when presented with two fuel-efficiency metrics (annual fuel cost and greenhouse gas rating) compared to one.

→ No color

*Figure 3. USA's Direct information disclosure label (Source: International council on clean transportation)*

# Soft Measures



## 6.6.1 Preferential/privileged parking in cities

Reduced parking fees can be a strong incentive for using clean vehicles — particularly in crowded cities. Special parking zones in cities give incentives to consumers to purchase fuel efficient vehicles when these vehicles are given special parking privileges in conditions of parking scarcity. Some cities even provide free parking for electric vehicles and hybrids.

So far, only one city in the Republic of Macedonia has introduced free parking for electric and hybrid vehicles[4]. In the city of Strumica, with the municipal decision from the Official Gazette of the Municipality of Strumica, 1.9.2015, free parking for electric and hybrid vehicles is provided in the zones A and B.

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[4] At the initiative of ElectroMobility, NGO, Republic of Macedonia

## 6.6.2    *Eco-driving*

Eco-driving comprises a set of techniques for a fuel-efficient driving style, where the core is anticipatory, calm driving with the intent of utilizing the power of the engine in the most efficient way. It has been suggested that if eco-driving became the dominant style of driving average fuel consumption may be reduced by 10 to 34%.

## 6.6.3    *Fuel options*

Many alternative fuels "burn" cleaner than gasoline or diesel so there are fewer tailpipe emissions. The amount of greenhouse gases (GHG) emitted when the fuel is produced depends on the source of the fuel. Many of these fuels, depending on how they are produced, reduce overall emissions of $CO_2$ into the atmosphere. Alternative fuels include gaseous fuels such as hydrogen, natural gas, and propane; alcohols such as ethanol, methanol, and butanol; vegetable and waste-derived oils; and electricity. These fuels may be used in a dedicated system that burns a single fuel or in a mixed system with other fuels including traditional gasoline or diesel, such as in hybrid-electric or flexible fuel vehicles.

# Policy effectiveness

This Policy Paper offers instruments which will improve the national average fuel economy by 2025, achieving average levels of 4.61 lge/100 km or 112.6 g $CO_2$/km, towards meeting the EU requirements on $CO_2$ emissions of light duty vehicles of 95 grams of $CO_2$ per kilometer, that is a fuel consumption of around 3.85 l/100 km (target from 2020). If no measures are applied, it is expected that by 2025 the average national fuel economy of vehicles will increase up to 7.73 lge/100 km or 188.5 g $CO_2$/km.
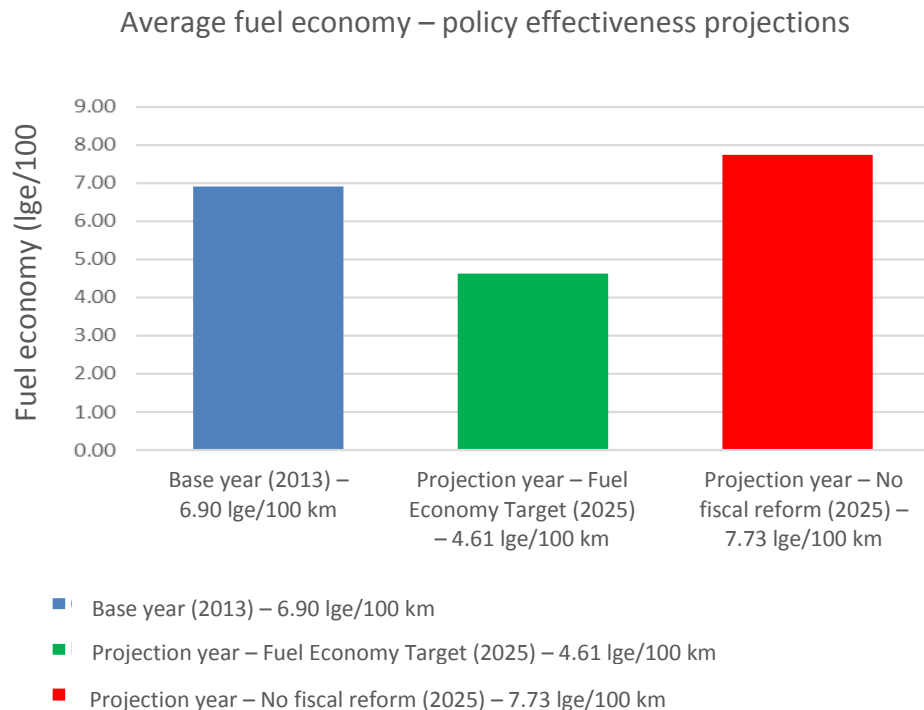
*Chart 1. Policy effectiveness projections for improving fuel economy*