FUEL ECONOMY BASELINE AND TRENDS-MALAWI

INSTITUTIONS

Ministry of Natural Resources, Energy and Mining;

Ministry of Transport and Public Works; University of Malawi;

National Commission for Science and Technology;

Ministry of Finance, Economic Planning and Development.

Outline of the Presentation

▶ Introduction

▶ Objectives of the Study

▶ Methodology

▶ Key Findings

▶ Policy Recommendations

Introduction

- The Global Fuel Economy Initiative (GFEI) was launched in 2009 with the aim of reducing localized air pollution and Green-House Gas (GHG) emissions through the promotion of cleaner and more fuel efficient vehicles.

- The Initiative is supporting countries to come up with an inventory of vehicles being registered and to come up with the average fuel Economy

- Malawi Government through support from UNEP conducted this study in 2017.

Malawi Vehicle Population

- Malawi as land linked country relies on Road transport.

  - 90% of Malawi's import and exports are by road

  - 99.9% of internal distribution is by road.

  - Vehicle population is at 290,735 ;

  - 17 vehicles per 1000 populations;

  - Vehicle growth rate of about 12% per annual

  - Currently Country is experiencing heavy congestions especially during peak hours

  - No Public Bus System- Minibuses are used to ferry people in towns

- Vehicle population to triple by 2036 from the current 290,735 to 1,034,000(Atkins, 2017).

- Fuel consumption is at 30 million liters/ month of both petrol and diesel.

Main objective

▶ The study was aimed at preparing vehicle inventory and vehicle import trends to establish average fuel economy for newly registered vehicles.

▶ **Specific objectives of the study were to**:

  ▶ Develop an inventory of vehicles imported during period between 2006 -2015

  ▶ Establish the average National fuel economy and average CO_2 emission.

  ▶ Review existing National regulations and incentives to promote cleaner and fuel efficient vehicles.

  ▶ Conduct Cost Benefit Analysis (CBA) of the various policy interventions.

Methodology

1. Compilation of Vehicle data

- Target was for first registered vehicles during period 2006 to 2015

- Data Sources
  - Directorate of Road Traffic and Safety Services (DRTSS)- **Oracle database.**
  - Plant Vehicle Hire and Engineering Services (PVHES) Database- **Manual System.**

- Military Vehicles, Malawi Police Service and Prison Service Vehicles were not included.

- **Challenge**: Information captured in both Oracle Database and by PVHES was limited.

2. Data Cleaning

Cleaning involved sorting out the raw data to fit the objectives of the exercise;

- ❑ Removal from the data set of vehicles not registered within the targeted years;

- ❑ Separation of new and used vehicles at time of registration;

- ❑ Addition of other relevant fields to make it as comparable with the GFEI database as possible

3. Data Structuring

The absolute Minimum required is the following:-

- ▶ Vehicle make and model

- ▶ Model production year

- ▶ Year of first registration, if different from model year

- ▶ Fuel type

- ▶ Engine size

- ▶ Domestically produced or imported

- ▶ New or second hand imported

- ▶ **Rated Fuel Economy per model and *Test cycle* basis.** This was done by getting data from country of origin or manufacturer or authorized websites.

- ▶ Number per model

4. Calculation of fuel Economy

► Calculation of the baseline fuel economy

► Once fuel economy data is available for at least 85% of the newly registered vehicles, weighted average fuel economy can be calculated using the following equation:

$$FE = \frac{\sum_i^n Reg_i \times FE_i}{\sum_i^n Reg_i}$$

With:

$$FE = weighted\ average\ fuel\ economy$$

$$Reg_i = number\ of\ newly\ registered\ vehicles\ of\ type\ i$$

$$FE_i = fuel\ economy\ of\ vehicle\ of\ type\ i$$

5. CO$_2$ Calculations

Carbon dioxide (CO2) Emission Computations

The CO2 emission rates are based on the annual weighted average emission per segment for petrol and diesel vehicles and estimated for the years.

$$\sum_1^n SVSi * Ci \Big/ TSy$$

where;

$SVSi$ = Total Sales (Vehicles Registered by PVHES & DRTSS in a given year

C_1 = Sales for a Particular Vehicle Segmentation and Fuel type

TS_y = CO2 Emission for a Particular Vehicle Segmentation and Fuel type

KEY FINDINGS

Current Policies on Clean and Fuel Efficient Vehicles

▶ Tax differential: Higher taxes for vehicles with big engine capacity than those with lower capacity

▶ Tax incentives for importation of fairly used vehicles: 0-8 years no import excise and for goods vehicles of 0-15 years.

▶ Blending of petrol with Ethanol (80:20) and have flex vehicles an blended diesel (9:91) with straight vegetable oils .

▶ Since 2016 Malawi is using 50ppm diesel.

ENGINE CAPACITY	AGE	DUTY RATES		
		Import Duty	Import Excise	Import VAT
1000cc-1499cc	0-8 years	25%	0%	16.5%
	8-12 years	25%	30%	16.5%
	12 years and above	25%	60%	16.5%
c 1500cc-1999cc	0-8 years	25%	15%	16.5%
	8-12 years	25%	45%	16.5%
	12 years and above	25%	75%	16.5%
2000cc-2499cc	0-8 years	25%	35%	16.5%
	8-12 years	25%	60%	16.5%
	12 years and above	25%	90%	16.5%
2500cc-2999cc	0-8 years	25%	45%	16.5%
	8-12 years	25%	70%	16.5%
	12 years and above	25%	100%	16.5%
Exceeding 3000cc	0-8 years	25%	55%	16.5%
	8-12 years	25%	80%	16.5%
	12 years and above	25%	110%	16.5%

Note that the analysis shows that the tax incentives on vehicle options has yielded minimal overall impact.
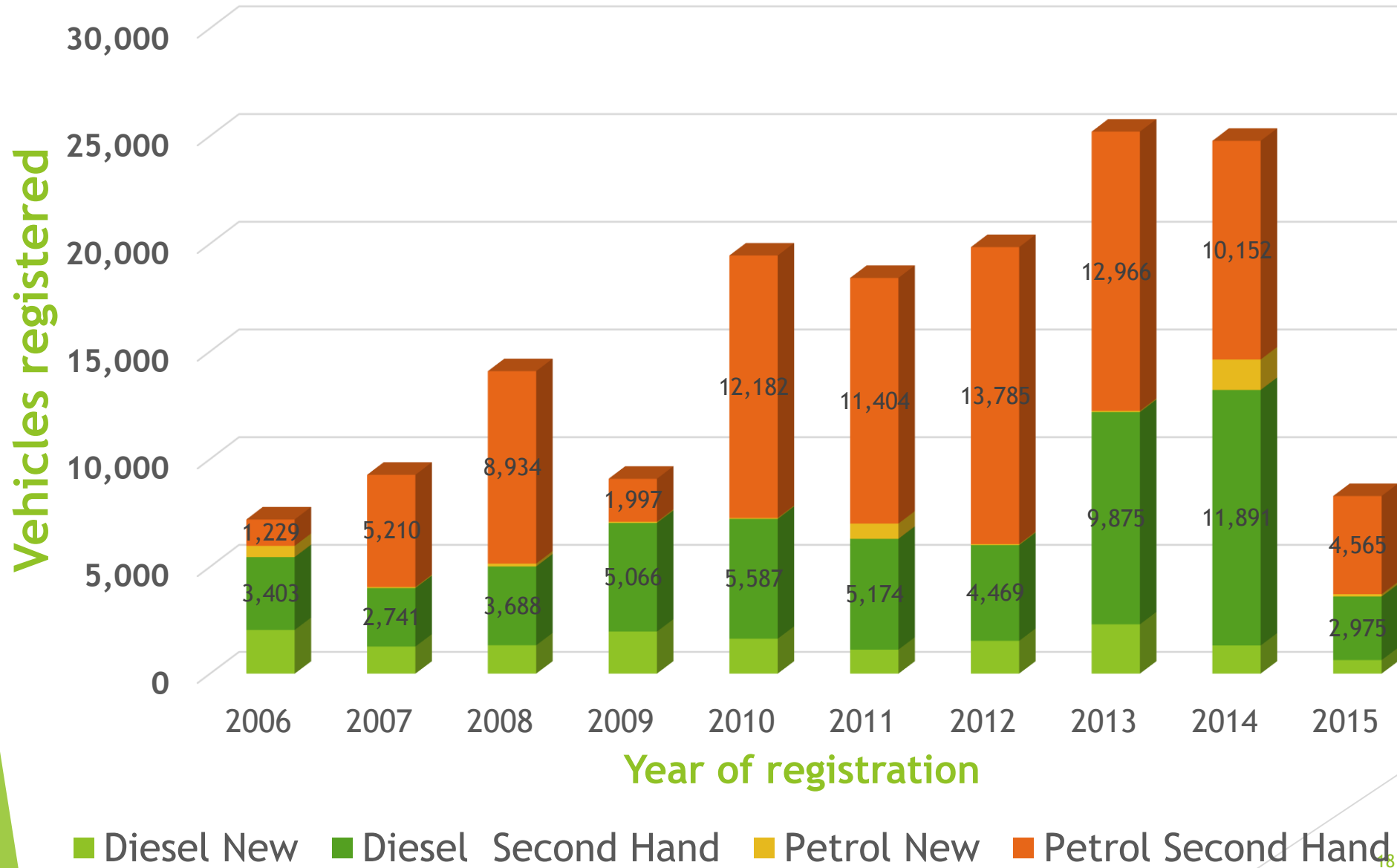
Vehicle Inventory
i. Imported vehicles

- From 2006 to 2015 **175,208** vehicles were registered

  - **70,031** were diesel vehicles (**22% New as percent of total**);

  - **95,555** were petrol driven vehicles (**3.3% new as % of total**); and

  - **9,622**-motorcycles

  - On average **17,521 vehicles** are registered per annual

  - Total of **165,586** Diesel and Petrol powered cars were imported in Malawi of which **18,293** were New and **147,293** were imported as second hand vehicles.

  - This implies that **89%** of registered vehicles were second hand. Vehicles are imported from South Africa, Japan or Europe.

Vehicle Imports by Engine Capacities

	Engine Capacity	Diesel				Petrol			
		New	Old	Total	New as % of total	New	Old	Total	New as % of total
LDVs	0-1000	9	426	435	2.1	1	498	499	0.2
	1001-2000	3651	11,518	15,169	24.1	1,356	70,645	72,001	1.9
	2001-3000	10284	25,136	35,420	29.0	1,754	4,726	6,480	27.1
	3001-3500	821	12,636	13,457	6.1	5	15,973	15,978	0.0
Sub Total		14,765	49,716	64,481	22.9	3,116	91,842	94.958	3.3
LDVs	>3500	397	5,153	5,550	7.2	15	582	597	2.5
Total		15,162	54,869	70,031	21.7	3,131	92,424	95,555	3.3

Motor Vehicles

Year	Diesel				Petrol				Total
	New	**Second Hand**	**Total**	**New as % of Total**	**New**	**Second Hand**	**Total**	**New as % of Total**	
2006	2,046	3,403	5,449	38	519	1,229	1,748	29.7	7,580
2007	1,267	2,741	4,008	32	51	5,210	5,261	1.0	10,148
2008	1,326	3,688	5,014	26	133	8,934	9,067	1.5	14,375
2009	1,968	5,066	7,034	28	53	1,997	12,050	0.4	19,297
2010	1,635	5,587	7,222	23	45	12,182	12,227	0.4	20,336
2011	1,124	5,174	6,298	18	707	11,404	12,111	5.8	19,811
2012	1,537	4,469	6,006	26	48	13,785	13,833	0.3	21,608
2013	2,308	9,875	12,183	19	53	12,966	13,019	0.4	27,337
2014	1,317	11,891	13,208	10	1,413	10,152	11,565	12.2	25,641
2015	634	2,975	3,609	18	109	4,565	4,674	2.3	9,075
Total	**15,162**	**54,869**	**70,031**	**21.7**	**3,131**	**92,424**	**95,555**	**3.3%**	**165,586**

Status at first Registration

Vehicles registered (y-axis)

Year of registration (x-axis)

Year	Value 1	Value 2	Value 3
2006	3,403	1,229	
2007	2,741	5,210	
2008	3,688	8,934	
2009	5,066	1,997	
2010	5,587	12,182	
2011	5,174	11,404	
2012	4,469	13,785	
2013	9,875	12,966	
2014	11,891	10,152	
2015	2,975	4,565	

Legend: ■ Diesel New ■ Diesel Second Hand ■ Petrol New ■ Petrol Second Hand

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Engine Capacities of Registered vehicles

▶ 75% petrol driven vehicles registered during this period had CC ranging from 1001-2000cc.

▶ 55% of diesel vehicles were of CC range 2001-3000CC

▶ 20% of diesel were HDV GVM of Grater 3500kg

▶ Diesel vehicles had bigger engine sizes than the petrol driven vehicles in the period under review.

Average Age of the vehicles

(CC)	Diesel				Petrol			
	2006	2009	2012	2015	2006	2009	2012	2015
0-1000	6	8	6	5	5	4	5	5
1001-2000	12	9	10	10	10	8	8	9
2001-3000	15	14	12	18	16	14	15	12
3001-3500	15	13	14	13	18	15	15	12
>3500	20	15	16	20	-	16		17
Average Age	14	12	12	13	10	11	11	11

Average Age of Diesel and Petrol Vehicles
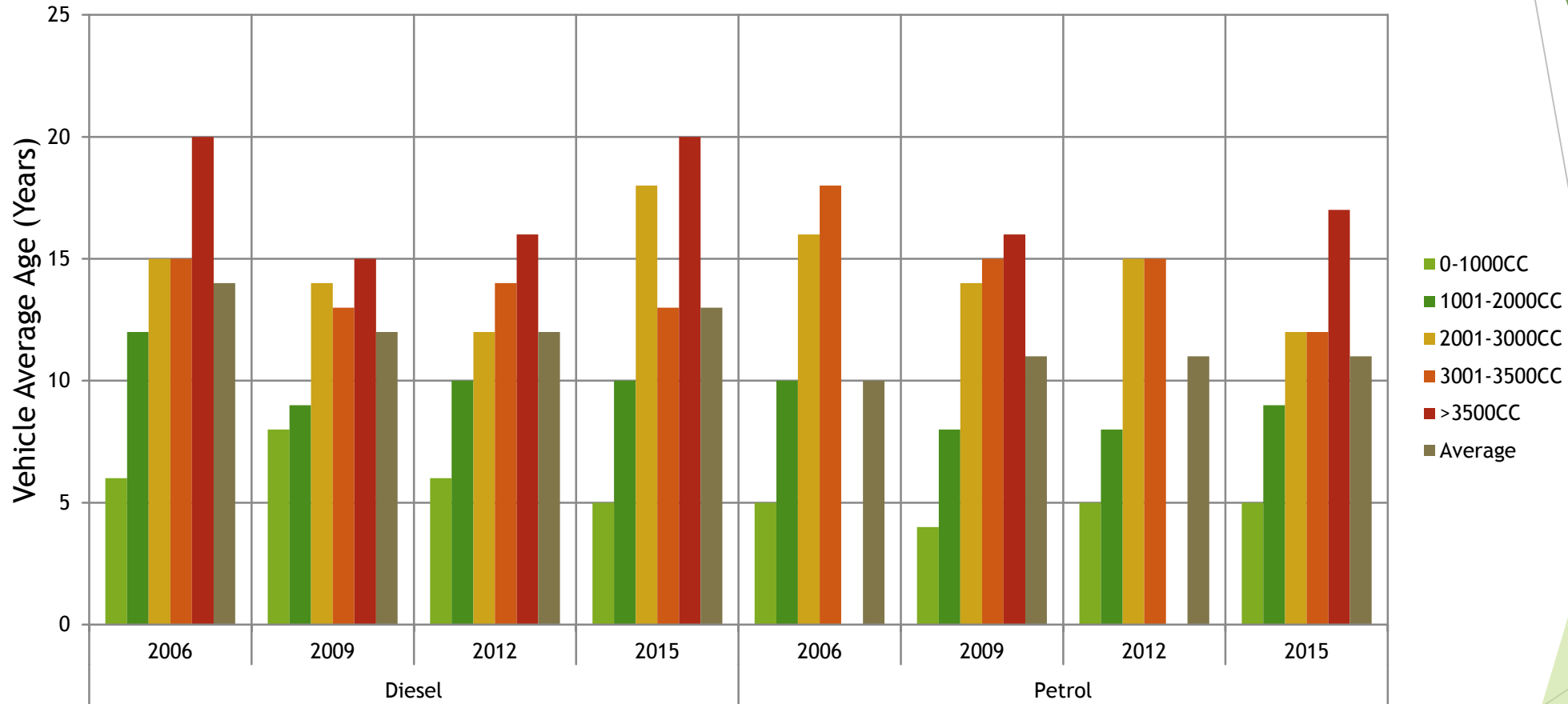
As seen the country has an aging population of vehicles.

Average National Fuel Economy

- Fuel economy and CO_2 emission were based on the GFEI methodology.

- Because of lack of data for 2005, 2006 was used as the baseline.

- Fuel efficiency rates expressed in terms of liters per 100 kilometers of travel (L/100 Km)

- CO2 emission rates in grams per kilometer (gCO_2/Km) for vehicles registered from 2006 to 2015

- Calculations for fuel economy were based on published data from manufacturers, Dealers and Distributors and GFEI recommended websites

- The engine capacity were categorized into 5 sub-groups (0 – 1000cc, 1001 -2000cc, 2001 – 3000cc and 3001 – 3500cc

- **Target was for Light Duty Vehicles, Motorcycles and Vehicles more than 3500 GVM were excluded.**

- Vehicles with engine capacity in each range are assumed to exhibit similar fuel efficiency and CO_2 emission rates

Annual Vehicle Efficiency and CO2 Emissions

| Year	Diesel Vehicles		Petrol Vehicles		Average	
	Fuel Efficiency (L/100km)	CO_2 Emissions (g/km)	Fuel Efficiency (L/100km)	CO_2 Emissions (g/km)	Fuel Efficiency (L100km)	CO_2 Emissions (g/km)
2006	10.0	264.5	8.5	197.4	9.5	242.2
2007	6.6	178.6	12.3	323.9	10.3	271.8
2008	8.3	218.4	7.5	179.5	7.7	190.0
2009	7.6	200.3	7.6	182.2	7.6	187.7
2010	7.9	209.1	6.6	158.2	7.0	172.2
2011	7.5	195.6	11.6	278.1	10.7	260.8
2012	7.6	202.1	7.9	185.5	7.8	189.4
2013	7.7	202.3	9.3	219.9	8.6	212.5
2014	7.7	200.6	7.1	165.2	7.4	183.2
2015	7.8	205.9	6.9	164.8	7.3	180.0
Avge	8.2	216.1	8.3	196.7	8.3	203.9

Vehicle Fuel Efficiency
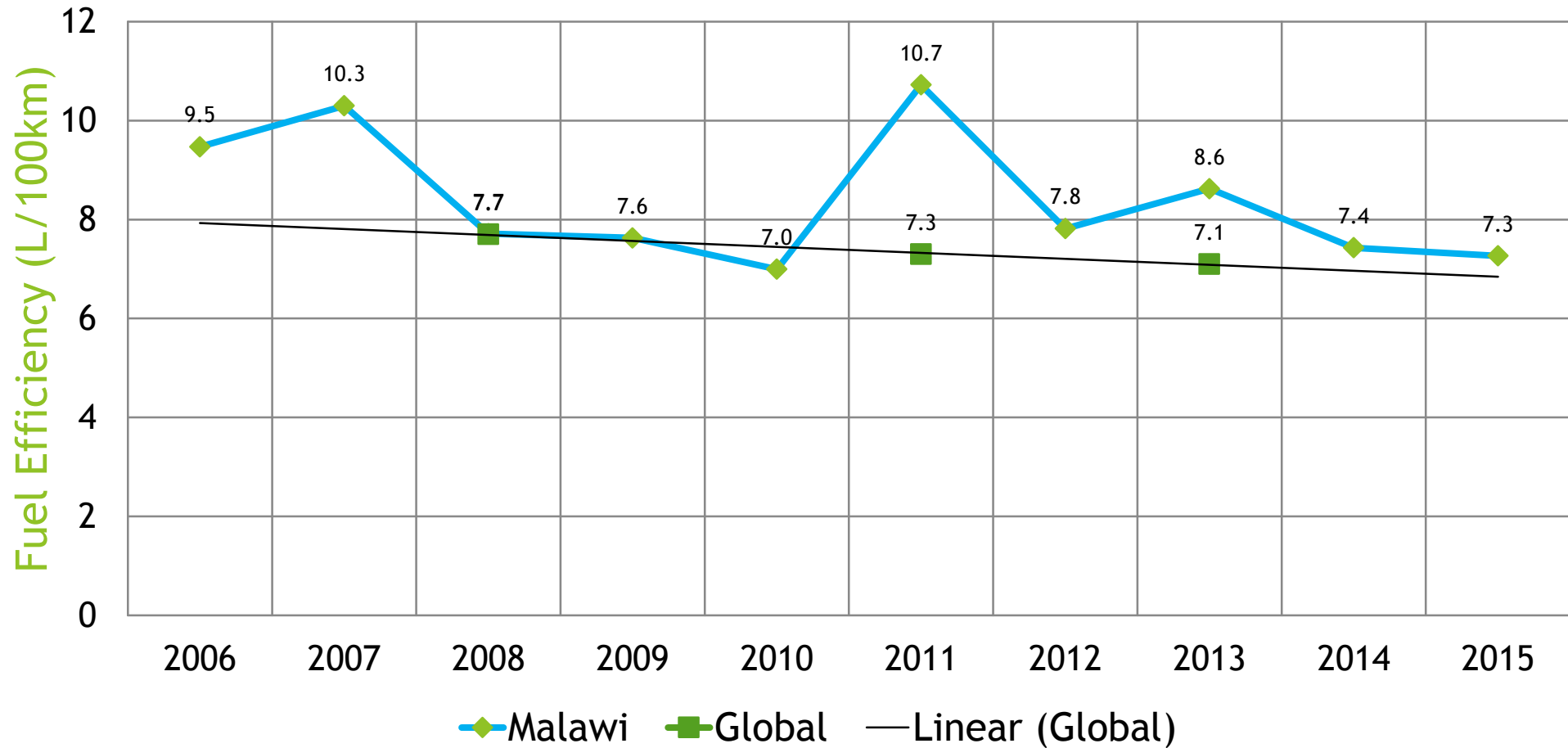
Comparison of Fuel Efficiency with other Countries

Year	USA	Europe	Japan	Australia	S. Korea	Kenya	Uganda	Mauritius	Malawi
2006	12.66	7.72	7.72	9.89	9.89	7.65			9.5
2007	12.61	7.53	7.53	9.74	9.89	7.62			10.3
2008	12.51	7.36	7.36	9.59	9.74	7.60	11.25		7.7
2010	12.17	6.88	7.19	9.31	10.21	7.40			7.0
2011	11.94	6.73	7.11		10.21	7.60	11.50		10.7
2012	11.72	6.59	7.03		10.21	7.70			7.8
2013									8.6
2014							12.6	5.9	7.4
2015								5.8	7.3

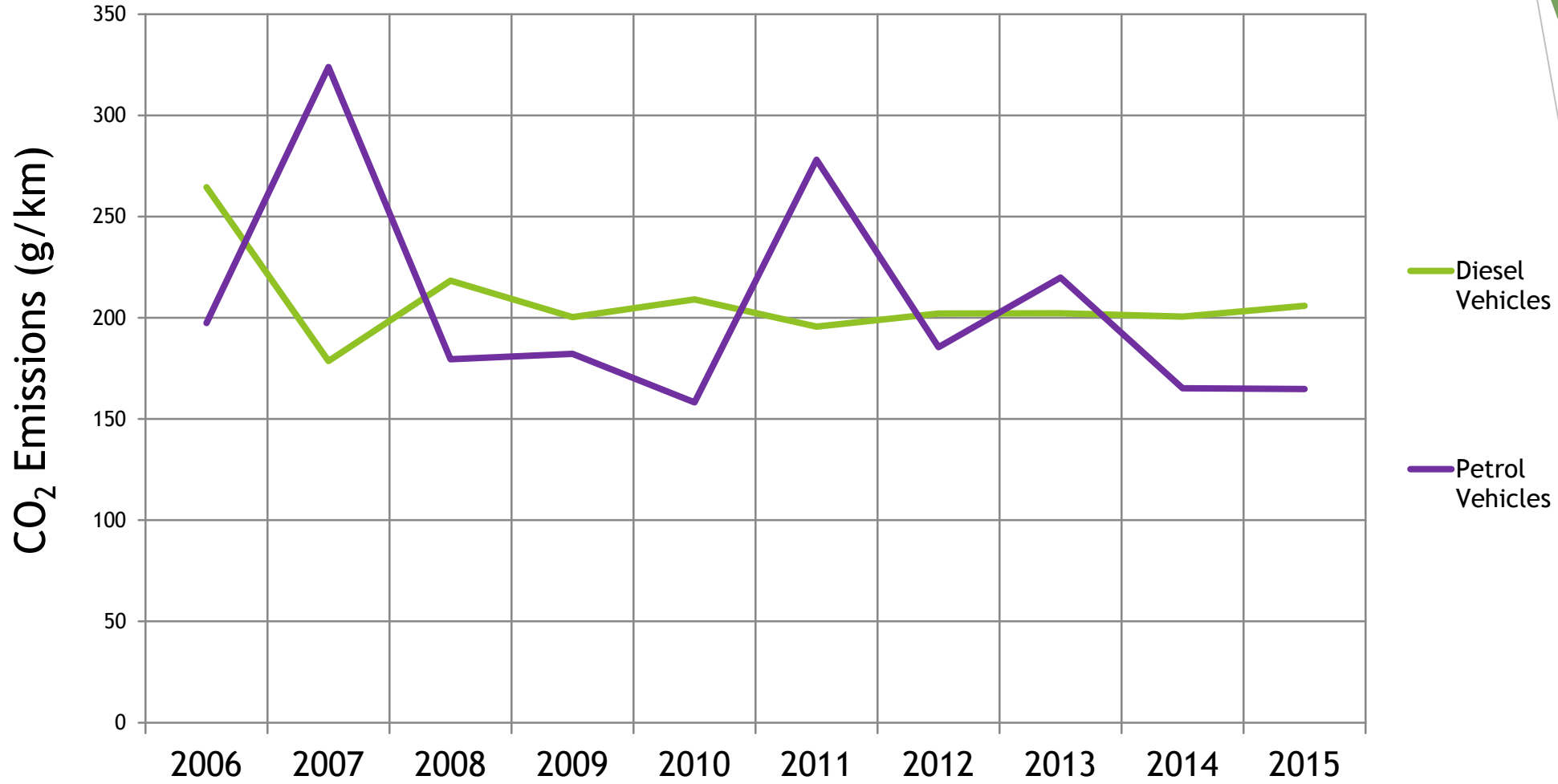# Fuel Efficiency - Comparison with other Countries
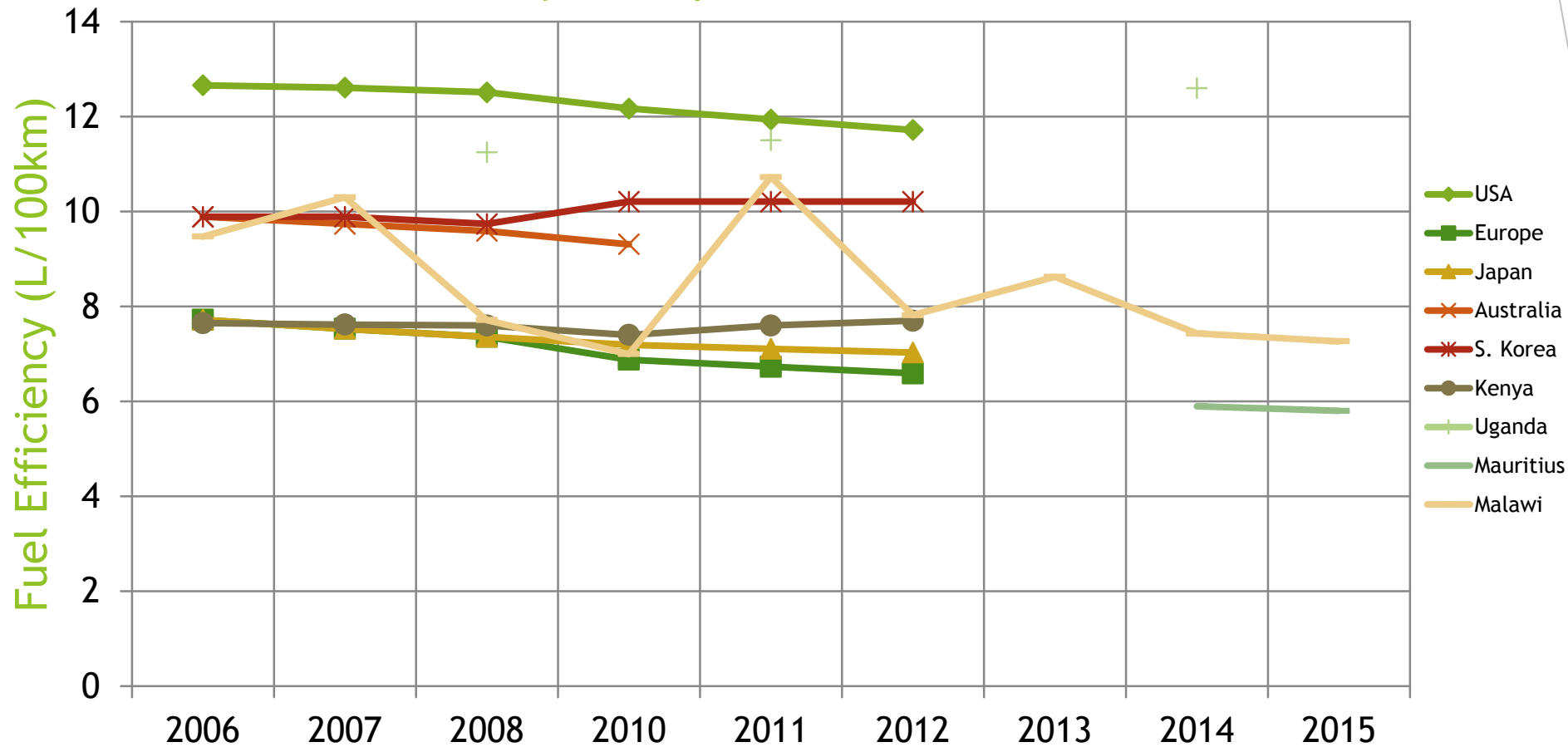
- The Malawi fleet has higher fuel efficiency as compared to countries such as Uganda, USA and Australia.
- However, the fleet of vehicles has lower fuel efficiency as compared to countries such as Mauritius, Europe and Japan.

iv. Comparison of Fuel Efficiency with the Global Average

> In general the average fuel efficiency for the country is lower compared to the global average.
> Malawi does not have any standards on fuel efficiency.

v. Vehicle CO_2 Emissions

vi. CO_2 Emissions – Comparison with other Countries

Year	USA	Europe	Japan	Australia	Canada	China	S. Korea	Kenya	Mauritius	Malawi
2006	255	160	148	192	222	190	198	184		242
2007	253	155	145	188	216	184	199	185		272
2008	250	150	142	185	210	178	199	185		190
2010	245	140	140	178	190	165	199	178		172
2011	243	138	138				200	182		261
2012	240	135	135				200	185		189
2013										213
2014									145	183
2015									146	180

CO$_2$ Emissions – Comparison with other Countries
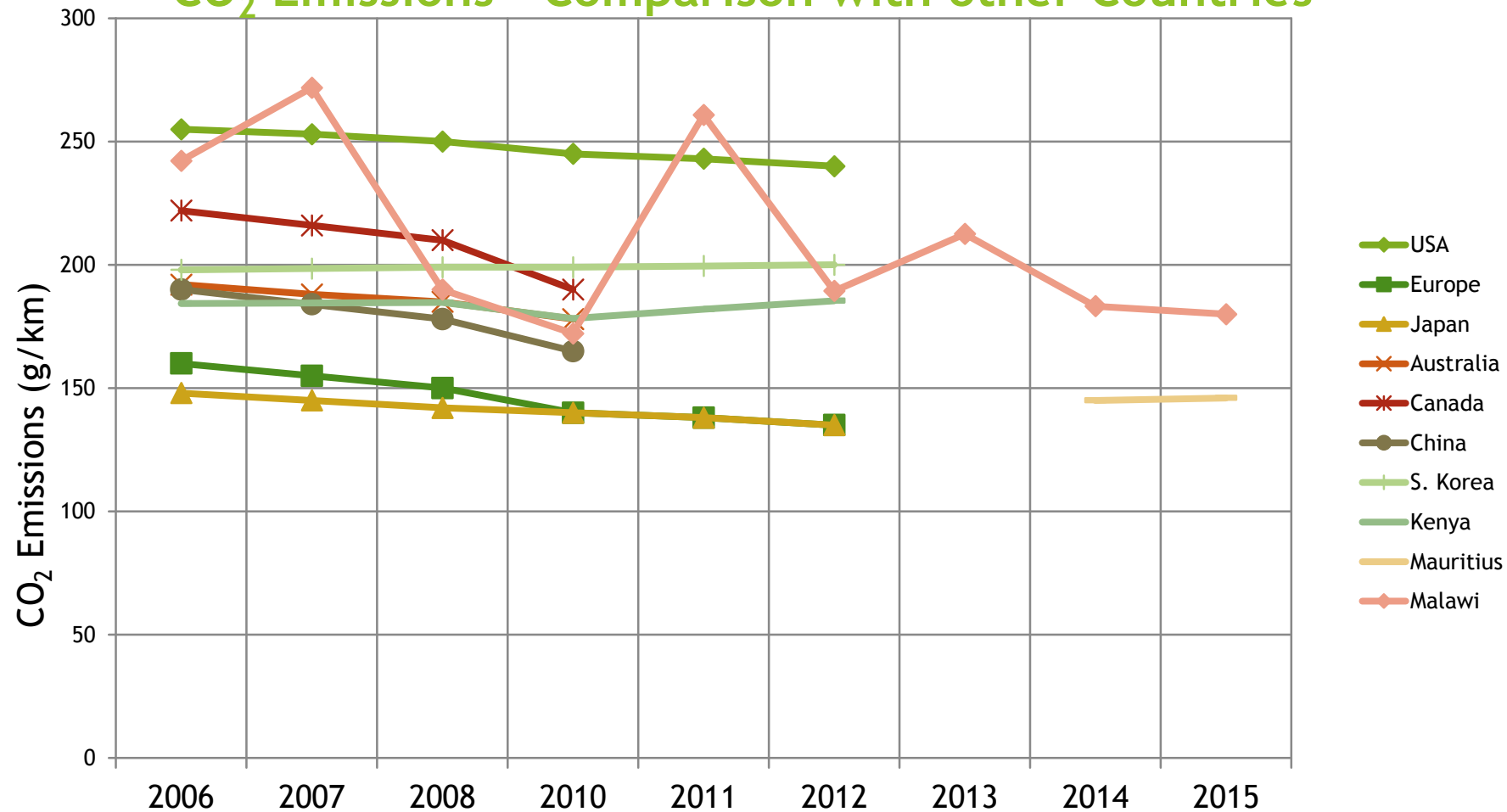
- In general the average CO$_2$ emissions for the country are lower compared to countries such as USA.
- However, CO$_2$ emissions are higher as compared t countries such as Japan, Europe and Mauritius.

Forecast of Low Duty Vehicles (LDVs) up to 2050

➢ Cumulative diesel Light Duty Vehicles registered are expected to increase to 125,000 in 2025 and 300,000 in 2050.

➢ Cumulative petrol LDVs registered are expected to increase to 215,000 in 2025 and 500,000 in 2050.

➢ For the same engine size diesel vehicles are more efficient than petrol vehicles. The increase in petrol vehicles would therefore reduce the overall vehicle fuel efficiency.

Study Limitations

❑ Incomplete, Insufficient data sets from both DRTSS and PVHES. Poor data management

❑ Military vehicles, Malawi Prisons; and Malawi Police Service were not included in the study.

Study Recommendations

❑ Malawi through Bureau of standards to develop vehicular emission standards

❑ Make Vehicle labeling mandatory for Malawi Market

❑ Introduction of CO2 based vehicle ownership tax (environmental tax).

❑ Introduction of vehicle Re-cycling Policy.

Study Recommendations

❑ Malawi to simultaneously implement a mix of vehicle policy options and fuel tax options to achieve affirmative impacts.

❑ Restricting importation of vehicles by putting maximum age limit for vehicle imports

❑ DRTSS and PVHES to collect additional data when registering the vehicles relevant for calculating fuel efficiency as well as CO_2 emissions.

THANK YOU FOR LISTENING

GOD BLESS YOU ALL