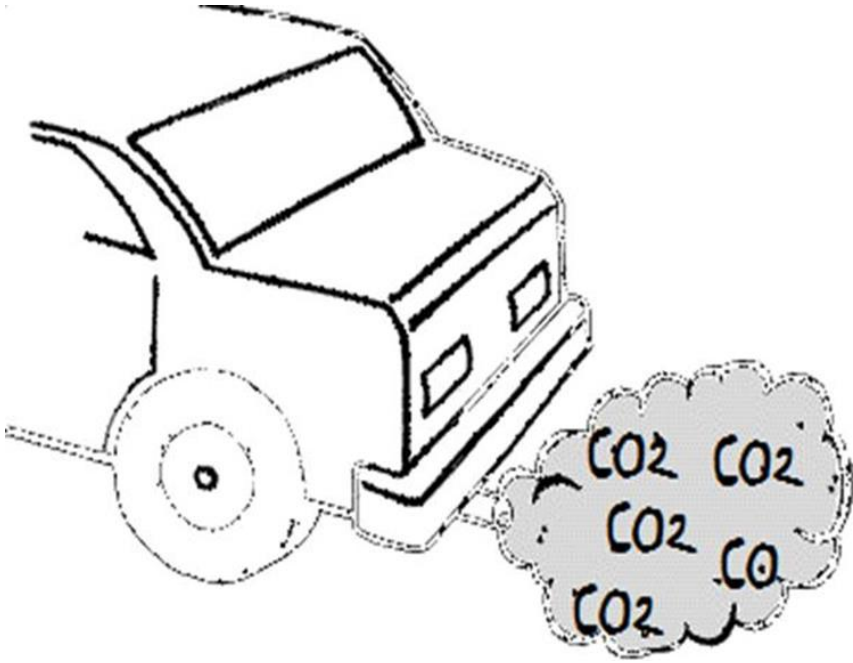
Overview of the Global Fuel Economy Initiative

Jane Akumu

UN Environment



UN Environment Transport Programmes

Share the Road (StR)

Global Fuel Economy Initiative (GFEI)

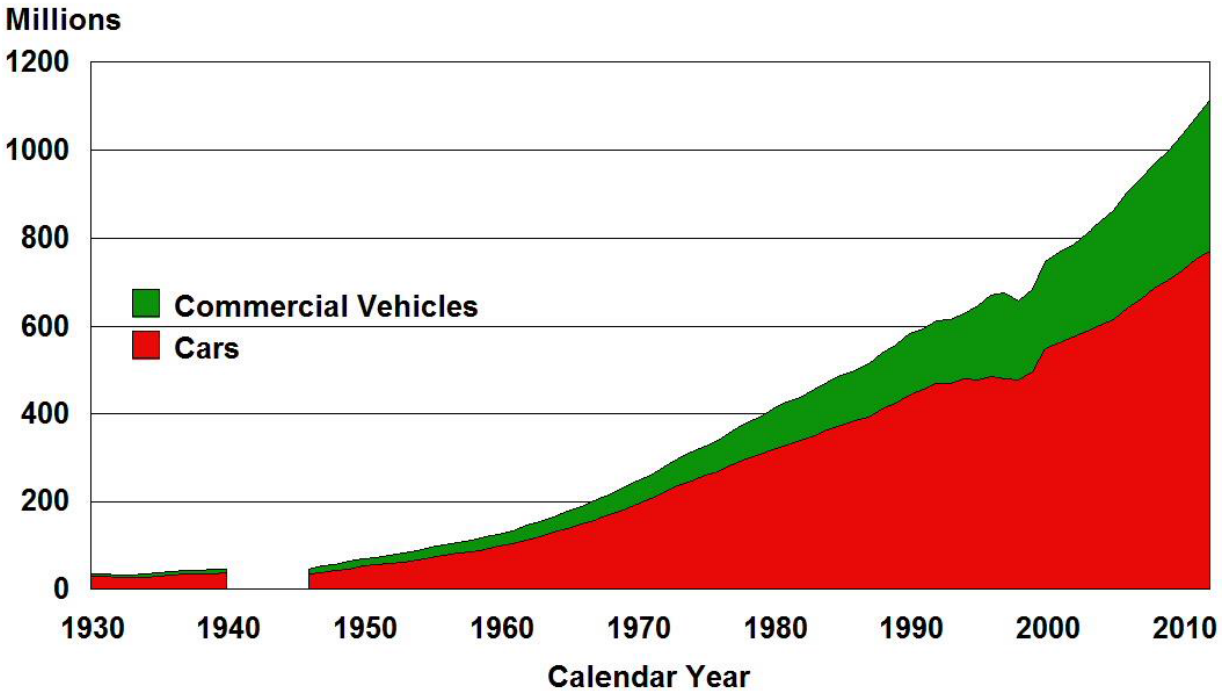
Electric Mobility

Partnership for Clean Fuels and Vehicles (PCFV)

Climate and Clean Air Coalition (CCAC)

Heavy Duty Diesel Initiative

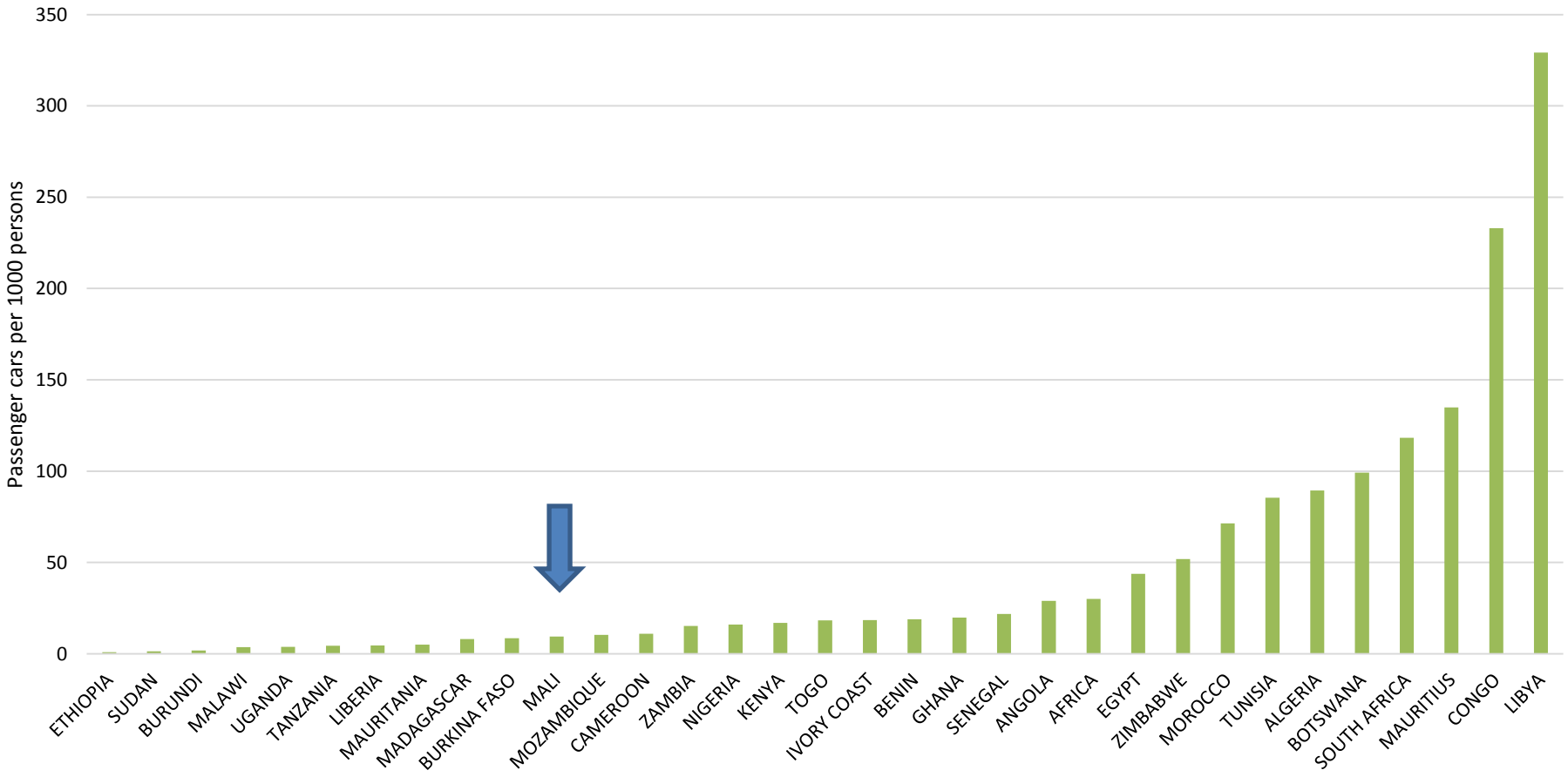
World Population of Cars, Trucks and Buses



- Vehicle fleet to ***triple*** (from ~1 billion to ~3 billon 2050)
- 90%+ of growth in non-OECD countries
- Few non-OECD countries have FE policies

Source: Mike Walsh

Motorization in Africa



Africa Sustainable Transport Forum ASTF

Impact of Transport

Air Quality & Health

- Largest source of air pollution in cities, exceeding WHO standards and costing more than 5% GDP

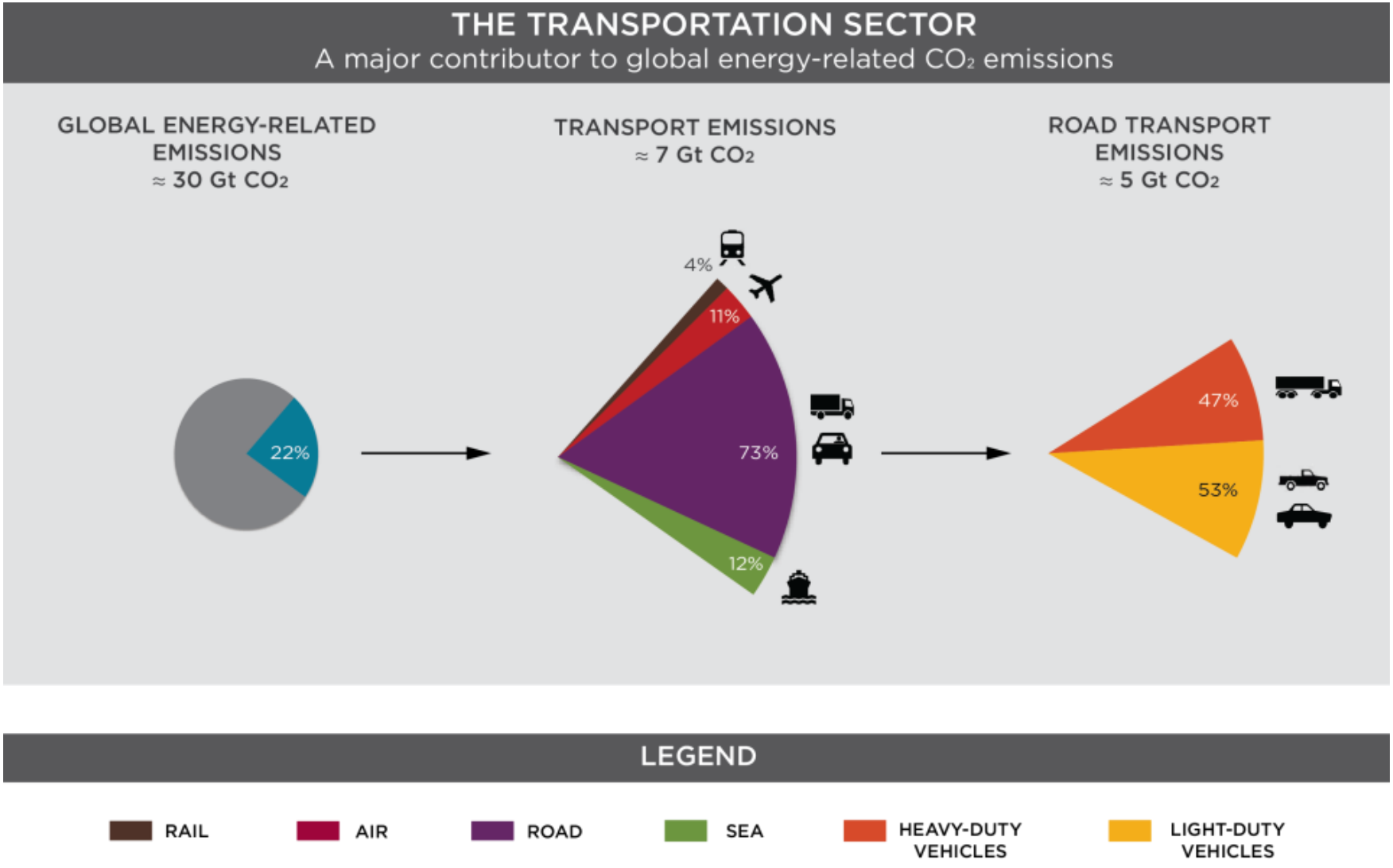
Energy Security

- Consumes 25% of world energy, 90% are fossil fuels

Climate Change

- Responsible for 23% global CO2 emissions & fastest growing sector in GHG emissions, 2.5% yearly until 2020

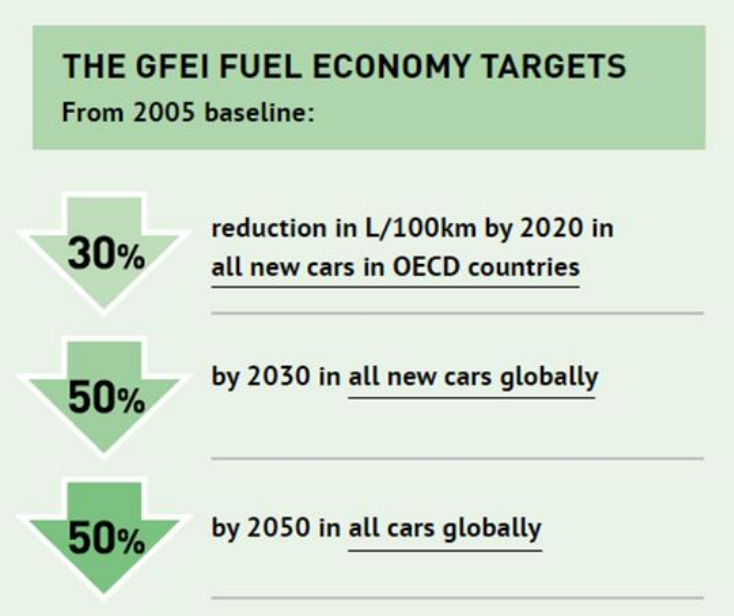
CO2 Emissions from Transport



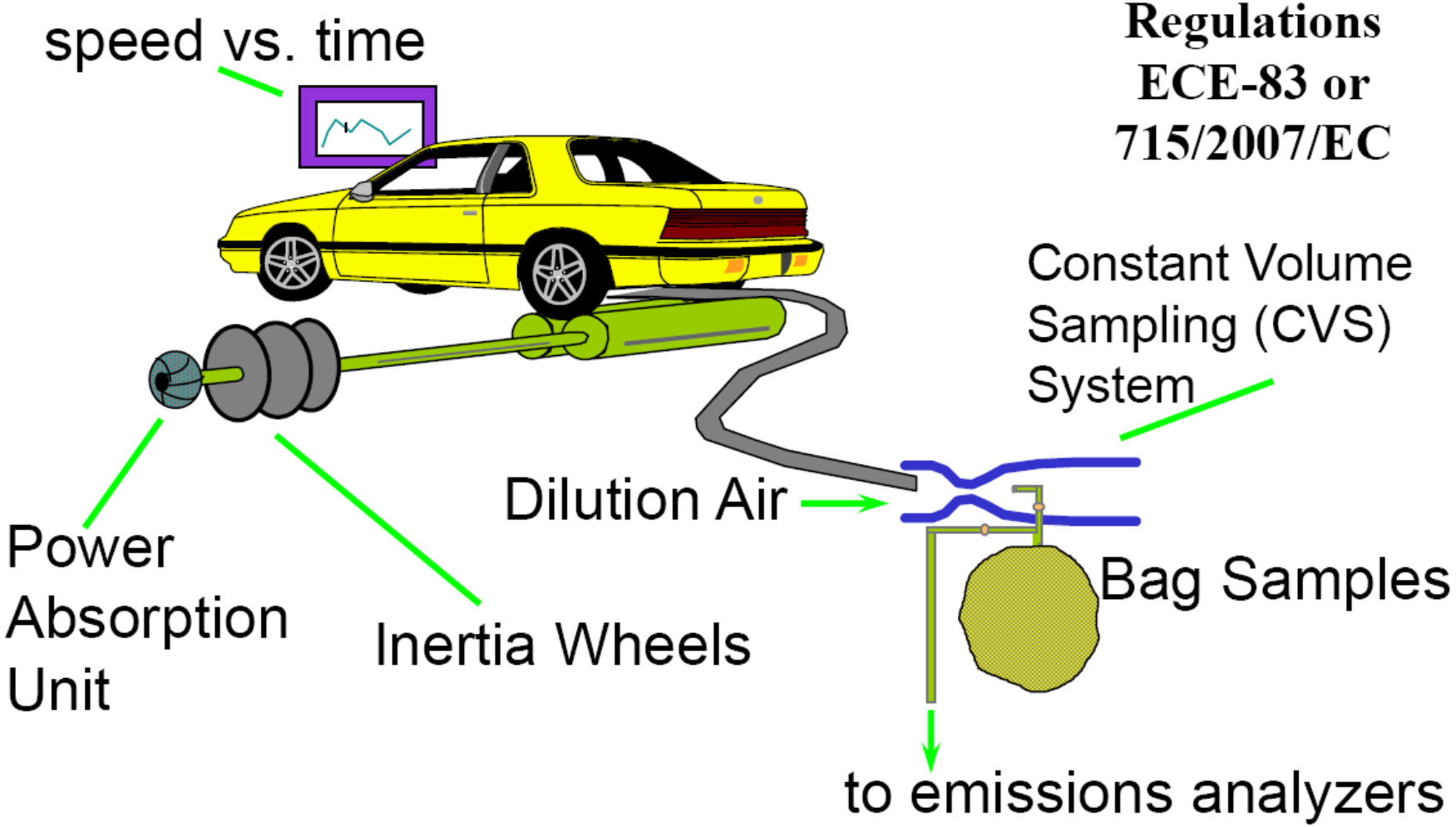
Sources:
ICCT (2014). Global Transportation Roadmap Model. Version 2.0. More information available at http://www.theicct.org/global-transportation-roadmap-model.
IEA (2012). CO2 Emissions from Fuel Combustion: Highlights. 2012 edition. Retrieved from https://www.iea.org/co2highlights/co2highlights.pdf.

What is fuel economy?

- Fuel economy measures energy per unit of vehicle travel
  - Litres per 100km (Europe)
  - Km per litre (Japan)
  - Miles per gallon (United States)
- Fuel economy, fuel consumption, fuel efficiency, fuel intensity are all fairly interchangeable terms.
- Also measured in CO_2 emissions
  - CO2 g/km
- Look for the tested fuel economy number for the vehicle



Typical Light Duty Vehicle Test Facility



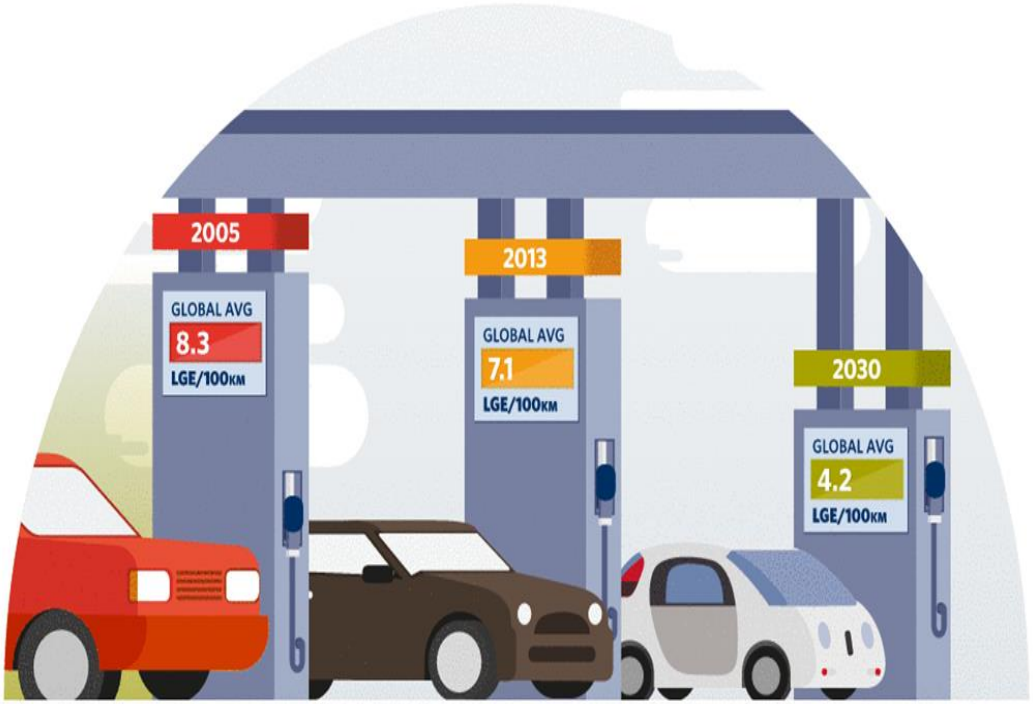
- Measurements in g/km, mg/km or #/km

Source: Stuart Rayner, NAAMSA

THE GLOBAL GOALS:
FUEL ECONOMY

DOUBLE AVERAGE FUEL ECONOMY

OF NEW CARS BY 2030
AND ALL CARS BY 2050



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GFEI Benefits

- Fuel savings: estimated at over USD 300 billion in 2025 and 600 billion in 2050
- CO2 reduction: estimated at over 1 gigatonne a year by 2025 and over 2 gigatonnes by 2050
- Reduced urban air pollution

Partners:

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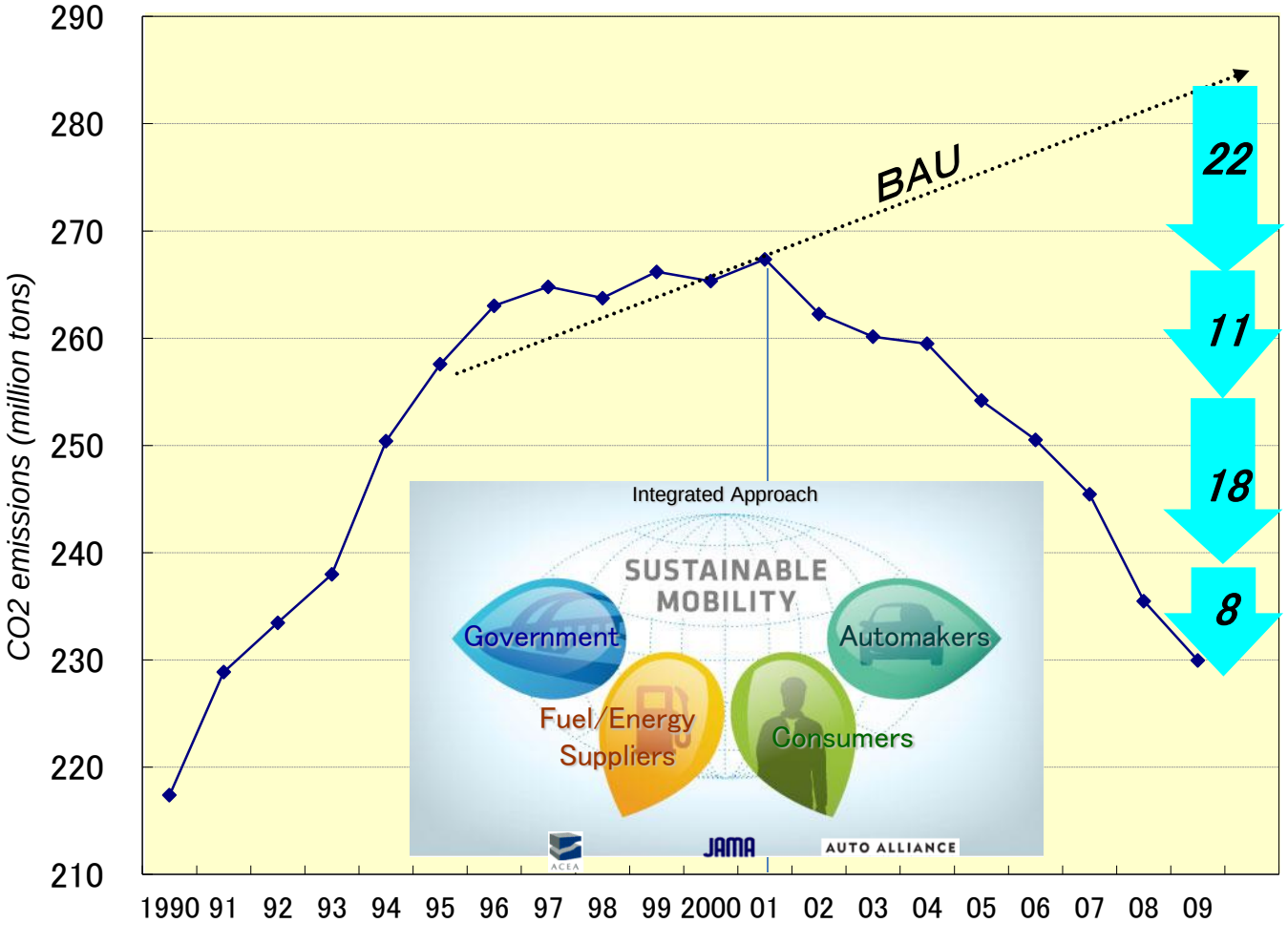
◆ CO_2 Emission Reduction in Japanese Transportation Sector



Fuel Economy

Traffic Flow

Eco-Driving

Alternative Fuels

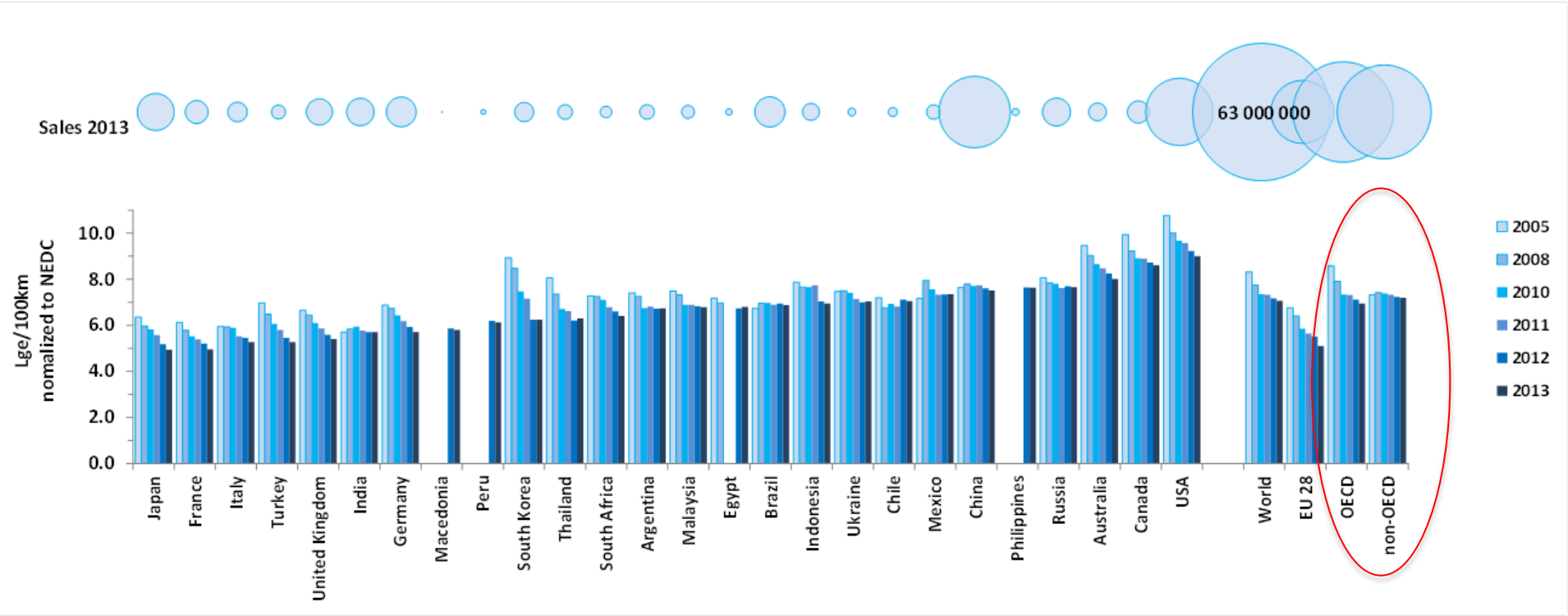
Travel Distance (modal shifts, etc)

Others

source : JAMA

Regional fuel economy trends

- Countries with FE policies in place show encouraging improvement rates
- Size shift vs. technology evolution moderates non-OECD improvement

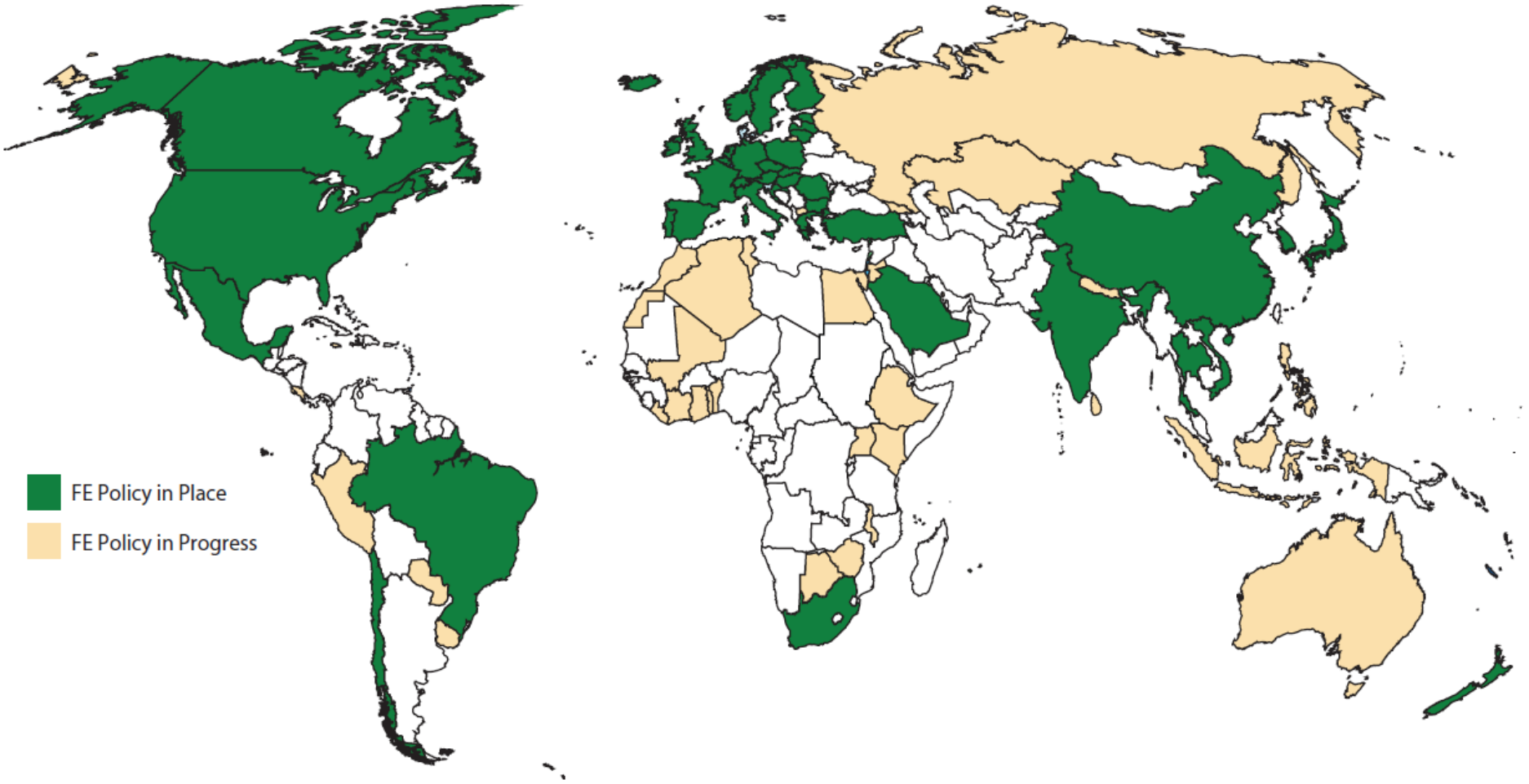


Source: IEA 2014

GFEI Country Engagement

countries with ongoing projects	new countries 2016/2017	Countries expressed interest
1Chile	28Malaysia	63Panama
2Ethiopia	29Bangladesh	64Iran
3Indonesia	30Kazakhstan	65Angola
4Kenya	31Mali	66Bhutan
5Georgia	32Nigeria	67Burkina Faso
6Ivory Coast	33Togo	68Burundi
7Mauritius	34Tanzania	69Cambodia
8Jamaica	35Rwanda	70Cameroon
9Montenegro	36Bolivia	71Cape Verde
10Macedonia	37Argentina	72D.R. Congo
11Costa Rica	38Ecuador	73Eritrea
12Vietnam	39Ukraine	74Fiji
13Morocco	40Jordan	75Guinea
14Bahrain	41Colombia	76Iran
15Tunisia	42Djibouti	77Kyrgyzstan
16Thailand	43Dominican Republic	78Laos
17Peru	44Guatemala	79Lesotho
18Russia	45Moldova	80Marshall Islands
19Benin	46Pakistan	81Mongolia
20Algeria	47Barbados	82Namibia
21Uruguay	50St. Lucia	83Niger
22Nepal	51Lebanon	84Papua New Guinea
23Paraguay	52Zambia	85Senegal
24Sri Lanka	53Ghana	86Sierra Leone
25Philippines	54Malawi	87Solomon Islands
26Uganda	55Zimbabwe	88South Africa
27Egypt	56Honduras	89Tajikistan
	57Nicaragua	90Turkmenistan
	58El Salvador	91Turkey
	59Botswana	92Armenia
	60Mozambique	93Azerbaijan
	61Myanmar	94Serbia
	62Liberia	95Samoa
		96Gambia
		97Uzbekistan
		98Bosnia-Herzegovina
		99Albania

Global Progress on Fuel Economy Policy (2017)



February 2017 - For more information visit www.globalfueleconomy.org

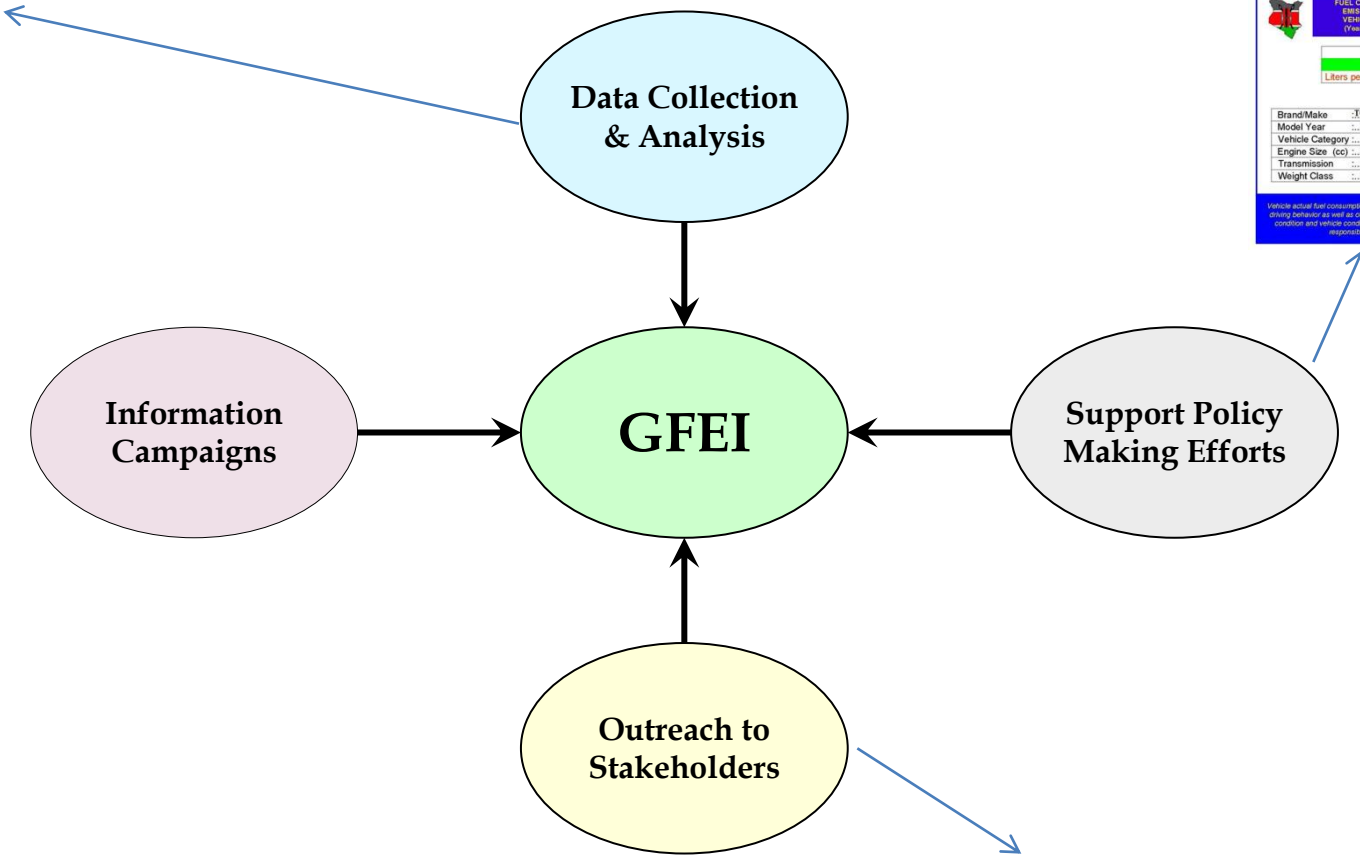
Global Fuel Economy Initiative (GFEI)

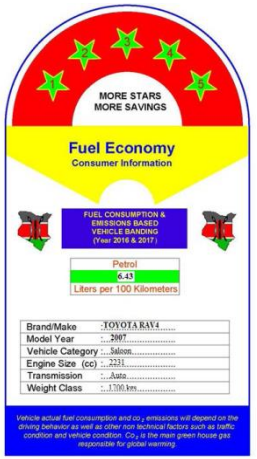
Importance of GFEI for Africa

- The project provides a good understanding of vehicles imported into the country e.g. models, sizes, technologies
- This will allow policy makers to choose the right combination of policy instruments to meet
  - national emission targets
  - energy security, and
  - efficiency goals

GFEI Activities

Vehicle Type
Model
Manufacturer
Body type
Simplified Body Type
Segment
Axle configuration
Driven wheels
Engine cylinders
Engine ccm
CC Category
Engine kW
KW class
Engine horse power
Engine valves
Fuel type
Model year
Number of gears
Transmission type
Turbo
Gross vehicle weight
Height
Length
Number of seats





Fuel Economy Estimation

- Data collection of light duty vehicle fleet (new and used imported vehicles < 3,500kgs)
  - Baseline Setting - 2005
  - Analysis of Trend (2010, 2013, 2016)
- Review of
  - Vehicle regulations
  - Fiscal incentives
  - Fuel standards
- Policy Options
- National Consultations

Minimum vehicle information required

- Vehicle make and model
- Model production year
- Year of first registration
- Fuel type (petrol or diesel)
- Engine size
- Domestically produced or imported
- New or second hand import
- Rated Fuel Economy per model and test cycle basis
- Number of sales by model

Additional information

- Vehicle Information / Identification Number
- Injection system type
- Body type
- Transmission type and other vehicle configuration details, as available
- Vehicle foot print
- Vehicle curb weight
- Emissions certification level
- Use of vehicle (private, public, for hire, etc.)

Estimating average fuel economy

- Look for the tested fuel economy number for the vehicle
- If not available the fuel economy figures for a given make, model and year can usually be retrieved from the vehicle manufacturers
- GFEI partners are compiling a list of fuel economies into a common database for use by countries undertaking baseline-setting exercise
- For the sake of comparison, all drive cycle data obtained be converted to the NEDC cycle
- Conversion factors can be downloadable from ICCT website www.theicct.org/info/data/GlobalStdReview_Conversionfactor.xlsx

Final Data

Make	Model	Condition	Body Type	Engine CC	Fuel Type	Model Year	Registration Date	L/100km	CO2
BMW	316I	Used	S.WAGON	1596	Petrol	1989	2005	7.5	176
CHEVROLET	OPTRA	Used	SALOON	1799	Petrol	2005	2005	6.2	145
CHEVROLET	NULL	Used	S.WAGON	1799	Petrol	2005	2005	6.2	145
NISSAN	SUNNY	Not Specified	SALOON	1970	Diesel	1998	2005	6.6	177
MITSUBISHI	LANCER	Used	SALOON	1600	Diesel	1998	2005	6.9	185
SKODA	OCTAVIA	Used	SALOON	1800	Diesel	2004	2005	7.0	188
SKODA	OCTAVIA	Used	SALOON	1800	Diesel	2005	2005	7.0	188
TOYOTA	COROLLA	New	S.WAGON	1970	Diesel	1998	2005	7.0	188
TOYOTA	COROLLA	New	SALOON	2000	Diesel	1998	2005	7.0	188
FORD	RANGER	New	VAN	2500	Petrol	2005	2005	8.1	170
HONDA	CR-V	NULL	S.WAGON	1970	Petrol	1998	2005	9.3	217

Average fuel economy

At the simplest level, taking a weighted average (by sales) of all new (including newly imported second hand) vehicles in the database will provide the average fuel economy of new vehicles sold in the country in the given year:

$$Harmonic\ average\ annual\ fuel\ economy = \frac{Total\ sales\ in\ the\ year}{\sum_1^n \frac{sales\ model\ i}{fuel\ economy\ model\ i}}$$

In a similar way, average CO_2 intensity can be obtained through weighted average with the sales of each model:

$$Average\ annual\ emission = \frac{\sum_1^n sales\ model\ i * emission\ model\ i}{Total\ sales\ in\ the\ year}$$

Additional information

- Examples of useful Websites on fuel economy include: http://www.carfolio.com/specifications/models; www.edmunds.com/toyota; http://www.carfolio.com/specifications/models/?man=4131
- http://www.epa.gov/fueleconomy/gas-label-1.htm; and http://www.carfolio.com/
- A Test Cycle Conversion Tool: www.theicct.org/info/data/GlobalStdReview_Conversionfactor.xlsx
- A global comparison of Vehicle Fuel Economy Standards: http://www.theicct.org/passenger-vehicles/global-pv-standards-update/
- South African Comparative Passenger Car Fuel Economy AND CO2 Emissions Data: http://www.naamsa.co.za/ecelabels/
- UNEP Vehicle Fuel Efficiency Baselines: Practicalities and Results - Global Fuel Economy Initiative in Africa, Working Session, November 2010. Summary and Country Case Study Presentations: www.unep.org/transport/PCFV/PDF/GFEIAfricaSummary_30%20November2010.pdf
- U.S. Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends (1975 through 2010): http://www.epa.gov/OMS/fetrends.htm
- U.S. Fuel Economy Policy: http://www.fueleconomy.gov/
- U.S. Fuel Economy Regulations: http://www.epa.gov/oms/climate/regulations.htm
- U.S. Auto Fuel Economy Database: http://www.fueleconomy.gov/feg/findacar.htm

Example of final data: Kenya Fuel Economy

Year	Average fuel consumption metric combined (L/100km)	Average CO_2 emission (g/km)
2010	7.4	178.2
2011	7.6	182.0
2012	7.7	185.4
Grand Average	7.5	181.7

Year of vehicle registration	Fuel Type		
	Diesel	Petrol	Grand Average
2010	8.0	7.2	7.4
2011	7.9	7.5	7.6
2012	8.0	7.6	7.7
Grand Average	8.0	7.4	7.5

Year of vehicle Registration	New	Used	Grand Average
2010	7.0	7.4	7.4
2011	6.6	7.6	7.6
2012	6.3	7.7	7.7
Grand Total	6.6	7.6	7.5

Fuel Economy Levels

Global	2005	2008	2011	2013
Average (l/100km)	8.07	7.67	7.2	7.1
OECD Average	8.1	7.6	7.0	6.9
Non-OECD Average	7.5	7.6	7.5	7.2

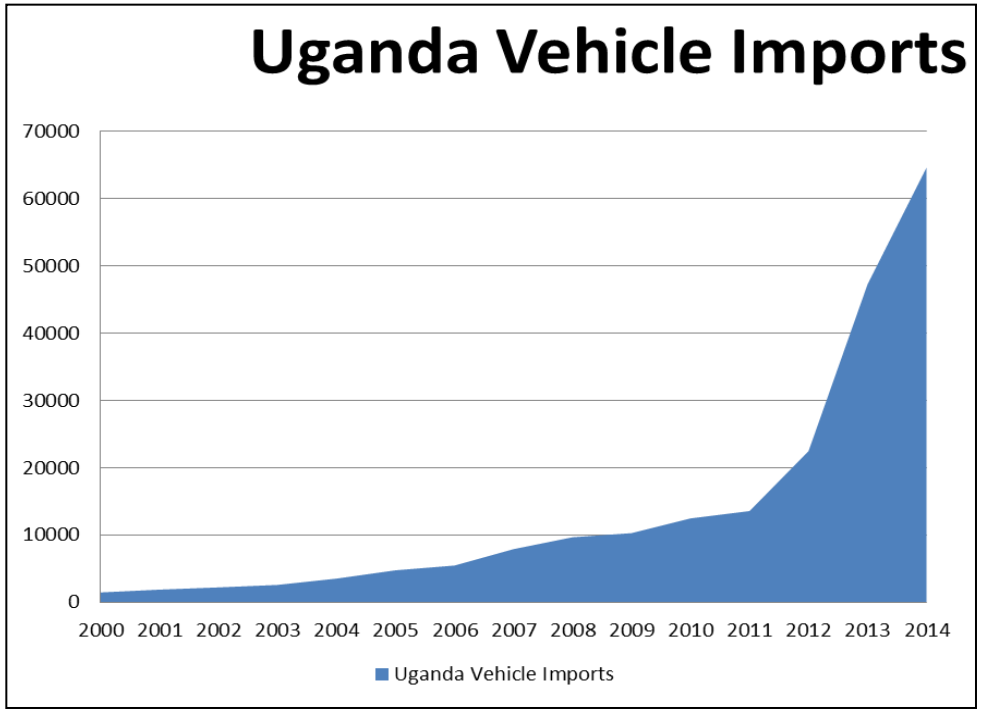
Uganda	2005	2008	2011	2014
Average (l/100km)	10.94	11.14	11.34	12.15

Mauritius	2005	2013	2014
Average (l/100km)	7.0	6.6	5.8

Kenya	2010	2011	2012
Average (l/100km)	7.4	7.6	7.7

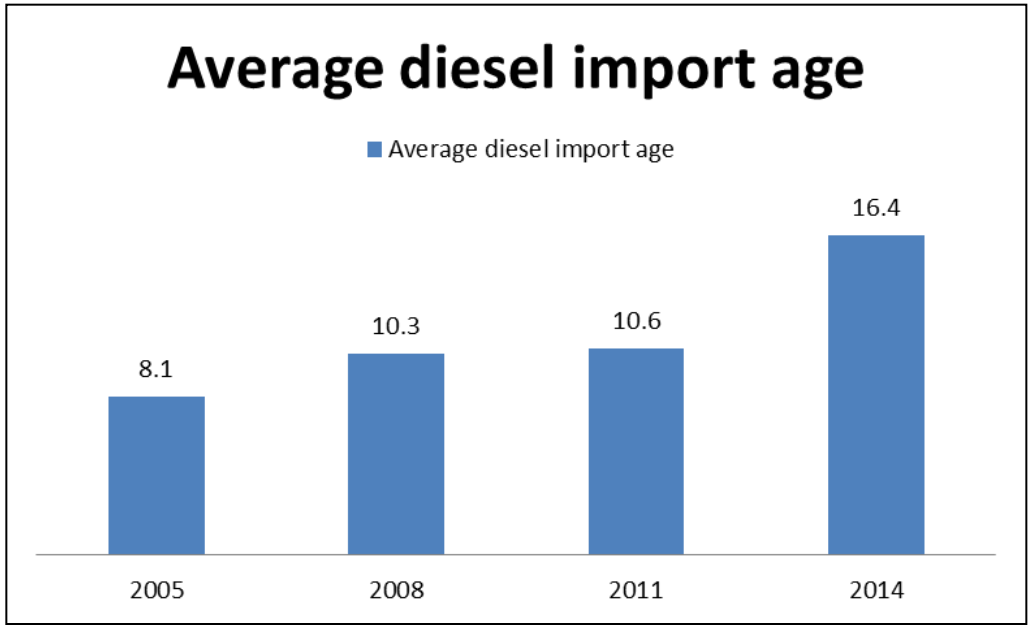
Algeria	2005	2008	2013
Average (l/100km)	7.5	7.4	7.0

Ethiopia	2005	2010
Average (l/100km)	8.4	7.9

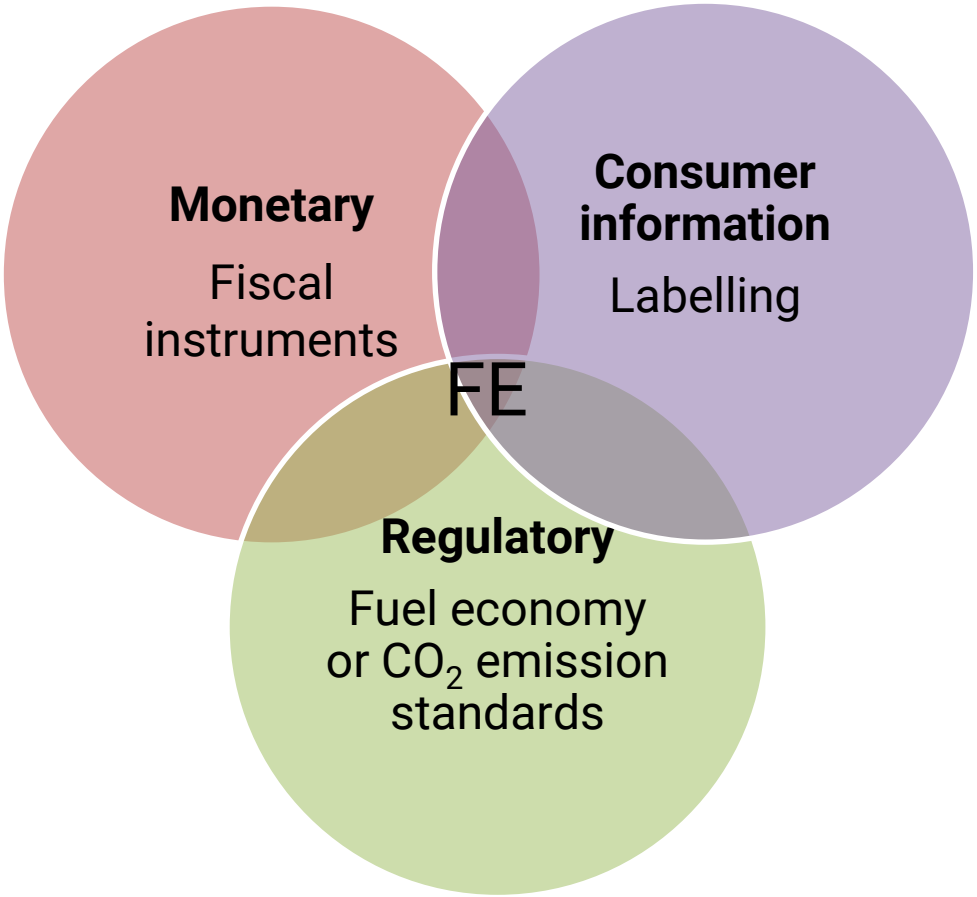


Example of Uganda

Uganda	2005	2008	2011	2014
Average (l/100km)	10.94	11.14	11.34	12.15



Fuel economy policies & instruments



Target group:

Consumer

Manufacturer

European Union

- 12% of total CO_2 emissions from transport
- average for all new cars is 130 grams of CO2 per kilometre (g/km) by 2015 and 95g/km by 2021
- reductions of 18% and 40% compared to 2007 -158.7g/km
- 2015 fuel consumption target
  - 5.6 l/100 km of petrol
  - 4.9 l/100 km of diesel
- 2021 target
  - 4.1 l/100 km of petrol
  - 3.6 l/100 km of diesel

China's Example

- China introduced Fuel Economy Standards for LDV in September 2004: phase 1 from July 2005 and 2 phase from Jan 2008
- Phase 1 increased the overall passenger vehicle fuel efficiency by 9%, and saved 575,000 tonnes of oil and 1.7 million tones of CO_2 emissions between 2002 and 2006
- Chinese FES is the 3rd most stringent in the world, behind the EU and Japan, reduction of average fuel consumption (litre/100km) of LDV by 11.5%

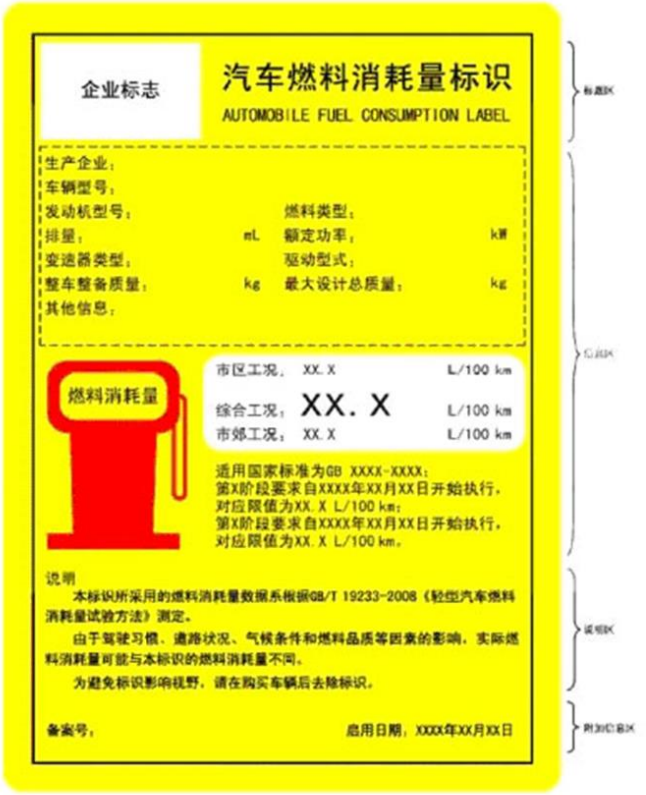
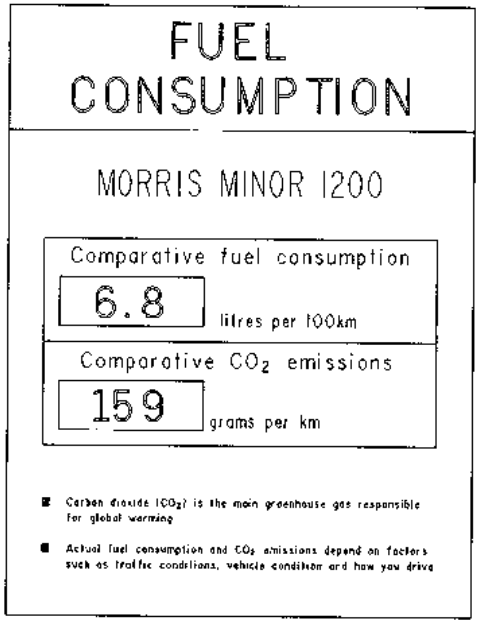


图 A.1 标识各功能区分布示意图

South Africa

- CO2 Taxation implemented March 2011
- The rate of emissions tax on passenger vehicles is R100 per gram CO2 emissions in excess of 120 g/km based on test reports
- The rate of emissions tax on double cabs is R100 per gram CO2 emissions in excess of 175 g/km based on test reports
- Vehicle labeling mandatory



Mauritius

- Adopted a feebate scheme in 2011 at 158 CO2g/km
- 2013 amended to 150 CO2g/km
- Fuel economy improved from 7l/100km in 2005 to 5.8l/100km in 2014
- 50 % excise duty waived on electric and hybrid cars and registration fee
- 2009 to 2014, hybrid increased from 43 to 1824 and electric cars from 0 to 8
- 2016 replace by a taxation system with additional incentives to electric vehicles

Type	Current	New
Conventional		
Up to 550 cc	15%	0
551-1000 cc	55%	45%
1001-1600 cc	55%	50%
1601-2000 cc	75%	No change
Above 2,000 cc	100%	No change
Hybrid		
Up to 1600 cc	55%	25%
1601-2000 cc	75%	45%
Above 2000 cc	100%	70%
Electric cars		
Up to 180 Kw	25%	0
Above 180 Kw	25%	No change

Labeling and CO_2-based Tax in Thailand

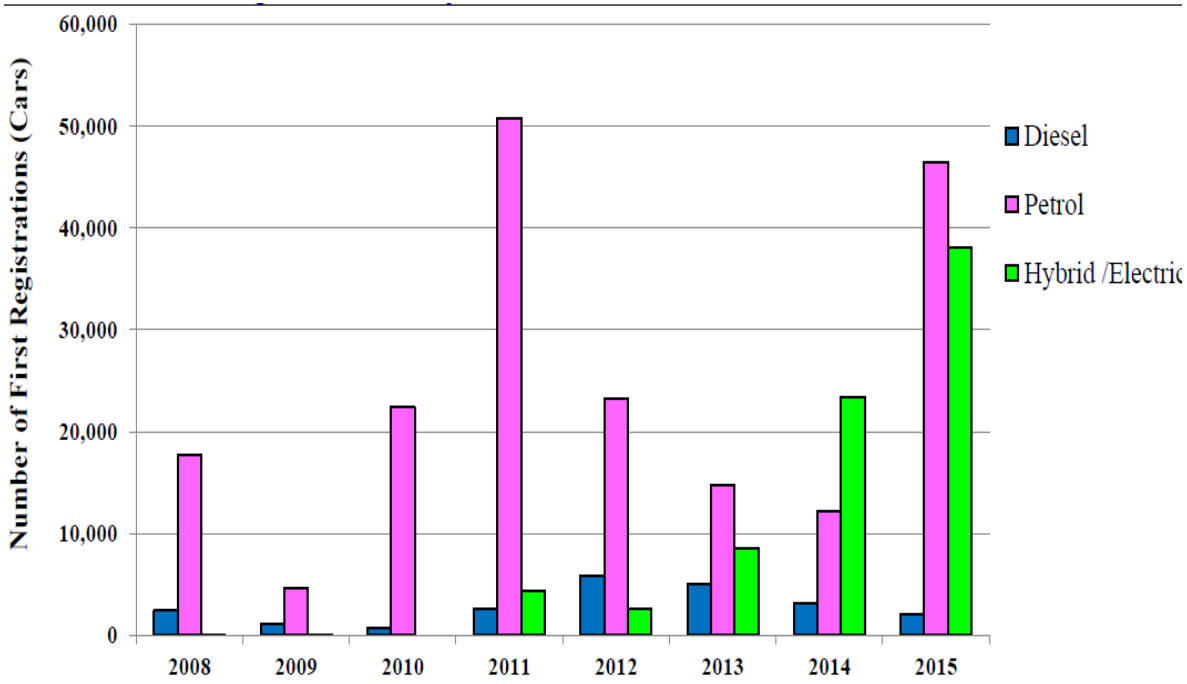
- Excise tax combines CO2 ratings/engine capacity/fuel type
- Mandatory eco-sticker

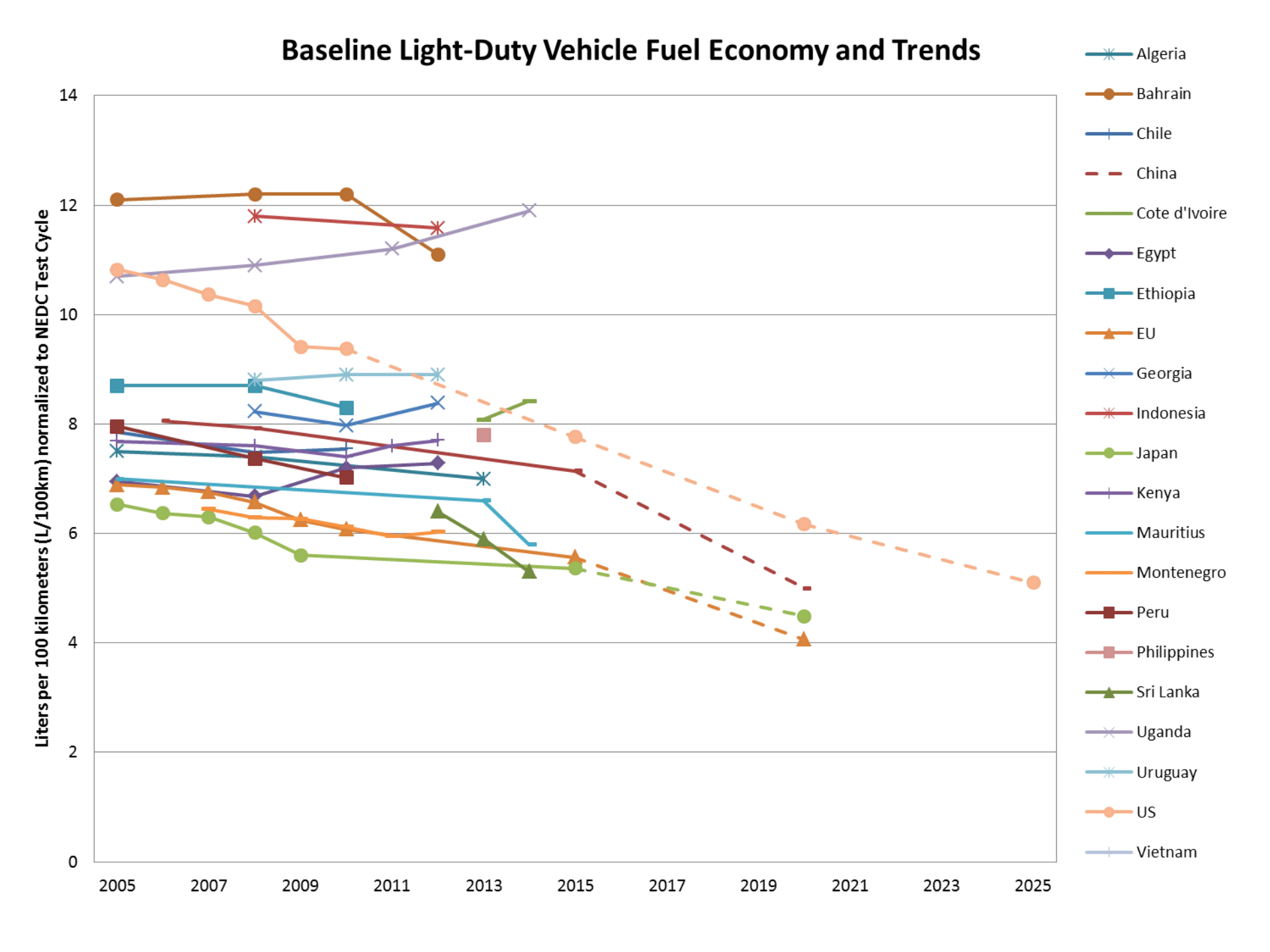
Types of Vehicles		Fuel type / Tax rates		
	CO2/ engine capacity	E10/ E20	E85/ NGV	Hybrid
Passenger vehicles – cars and vans with less than 10 seats	≤ 100 g/km	30	25	10
	101-150 g/km	30	25	20
	151-200 g/km	35	30	25
	>200 g/km	40	35	30
	>3,000 cc	50	50	50
~~				
Electric vehicle/ fuel cell	≤ 3,000 cc (180 Kw)	10		
	> 3,000 cc (180 Kw)	50		

Source: Energy Policy and Planning Office and Department of Alternative Energy Development, 2015

Hybrid and Electric cars in Sri Lanka

- Hybrid and electric cars in 2014 was 56% of the total number of cars
- Hybrid-petrol, petrol and diesel vehicles attract 58%, 253% and 345%, respectively, in excise tax
- Fully electric vehicles are levied at 25%.




Baseline Light-Duty Vehicle Fuel Economy and Trends
Liters per 100 kilometers (L/100km) normalized to NEDC Test Cycle
0
2
4
6
8
10
12
14
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
Algeria
Bahrain
Chile
China
Cote d'Ivoire
Egypt
Ethiopia
EU
Georgia
Indonesia
Japan
Kenya
Mauritius
Montenegro
Peru
Philippines
Sri Lanka
Uganda
Uruguay
US
Vietnam

Two-wheelers Emissions Comparison – Total Emissions [g CO_2 –equivalents / km]

One two-stroke scooter emits double the NOx emissions of a modern passenger car, 300 times the HC emissions and 80 times the CO emissions.

Two-stroke Scooter

Four-stroke motor cycle

Electric scooter
(China energy mix: 724g/kWh)

Passenger Car
(petrol, Golf segment)

Particle Emissions [g PM/ km]

0.5g/km

0.1g/km

0.017g/km
(China energy mix)

0.002g/km

UNEP

Graphics based on data from: Swiss EMPA, Materials Science & Technology "Umweltnutzen von E-Scootern"; TÜV NORD CERT, Bericht-Nr.: 8000410537-1 "Umweltprädikat Golf Modelljahr 2012"; ADB 2009 "Electric Bikes in the People's Republic of China Impact on the Environment and Prospects for Growth"

Summary

- High growth rate of passenger car sales (and other vehicles) with relatively high fuel economy will persist without fuel economy policies
- Implementing fuel economy policies can substantially reduce CO2 emissions – supporting the Paris Agreement
- Also reduces fossil fuel consumption and national expenditures on fossil fuels
- Improves air quality through adoption of more advanced vehicles and technologies

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