WORK GROUP 4

VEHICLE INVENTORY AND DEVELOPMENT OF A DATA ENTRY TOOL

TEAM COMPOSITION – WGP 4

Representatives of

- -National Transport Authority (Team Leader)
- -Ministry of Social Security & Environment and Sustainable Development
- Ministry of Finance and Economic Development
- -Ministry of Industry and Commerce and Consumer Protection
- -Ministry of Public Infrastructure and Land Transport
- -Mauritius Revenue Authority
- -University of Mauritius (Faculty of Engineering)

Terms of Reference

Vehicle Inventory in Mauritius

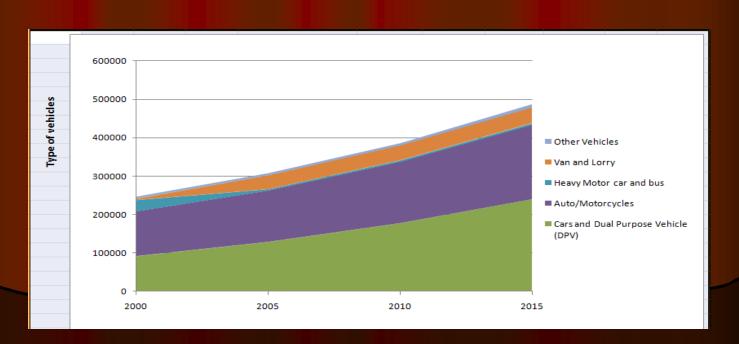
- Carried out in two phases
- Terms of Reference Phase 1 to set up a vehicle data inventory for the years 2005, 2008, 2010 and 2012 for newly registered light duty vehicle (LDV).
 - to use the vehicle inventory to develop baseline estimates for 2005 as per GFEI methodology.

Terms of Reference

- Terms of Reference Phase II to assess fuel consumption and Co₂ emissions for both LDVs and Heavy duty Vehicles (HDVs) for the years 2014 and 2015.
 - to develop a data entry tool for future vehicle imports
 - to conduct a thorough review of existing regulations and incentives to promote cleaner and more efficient vehicles in Mauritius.
 - to look into the modernization of public transport.
- Phase 1 completed August 2014
- Phase II completed March 2017

Vehicle Registered in Mauritius 2000 - 2015

Types of vehicle	2000	2005	2010	2015
Cars and Dual Purpose Vehicle (DPV)	89,823	126,844	175,634	237,600
Auto/Motorcycles	116,478	133,430	159,329	193,688
Heavy Motor car and bus	29,292	3,605	4,094	4,264
Van and Lorry	3,310	36,036	39,100	41,601
Other Vehicles	5,115	5,581	5,958	8,991
Total	244,018	305,496	384,115	486,144
			Growth rate %	4.7
				4.7



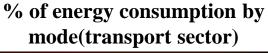
LDVs Registered 2000 - 2015

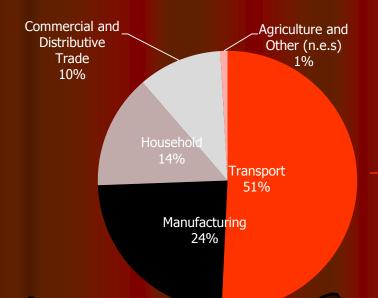
Year	Petrol	Diesel	Hybrid	Electric	LPG	Total	Annual Growth Rate
2005	98,744	42,618	0	0	224	141,586	-
2006	106,382	45,309	0	0	227	151,918	7.3%
2007	114,536	48,108	0	0	230	162,874	7.2%
2008	124,813	51,095	0	0	232	176,140	8.1%
2009	133,807	53,486	43	0	238	187,574	6.5%
2010	142,910	56,014	161	0	244	199,329	6.3%
2011	151,842	58,463	315	2	246	210,868	5.8%
2012	163,125	61,096	703	5	247	225,176	6.8%
2013	175,938	63,446	1,389	6	251	241,030	7.0%
2014	198,153	66,552	1,824	8	252	266,789	10.7%
2015	220,954	68,747	2,422	19	253	292,385	9.6%

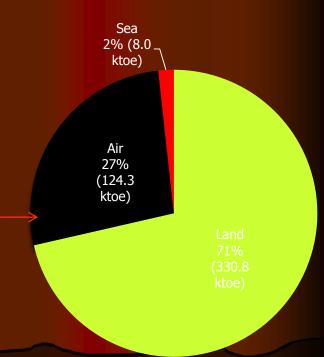
Overview of Fuel Consumption and Co₂ Emissions (2015)

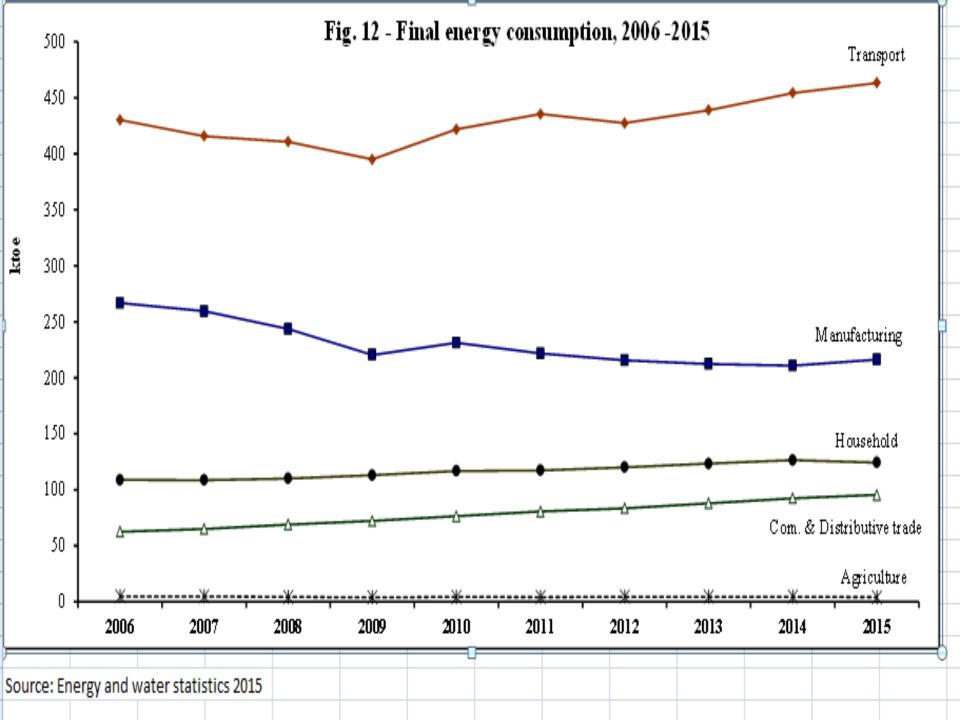
Final energy consumption by sector

	ktoe
Transport	463.1
Manufacturing	216.2
Household	129.9
Commercial and Distributive Trade	95.5
Agriculture and Other (n.e.s)	8.1
Total	912.8



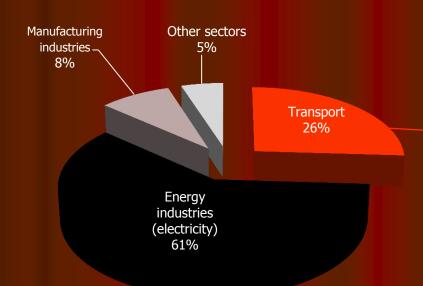




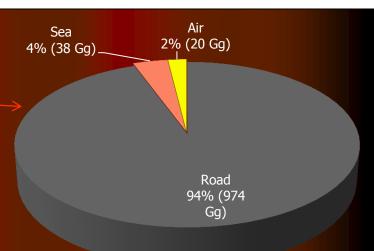


Co₂ emission by source category 2015

	Gg
Transport	1032.06
Energy industries (electricity)	2407.52
Manufacturing industries	337.78
Other sectors	198.2
Total	3,975.56



Share of Co₂ emission by mode transport sector



Minimum Vehicle Information Requirements for Data Inventory

- Vehicle Make and Model
- Model Production Year
- Year of 1st Registration
- Vehicle Identification Number
- Fuel Type
- Imported (New or Second Hand)
- Number of vehicles sold by model
- Body Type
- Engine Capacity
- Rated fuel economy per model and "test cycle" basis
- Fuel Injection type
- Transmission type
- Vehicle footprint
- Vehicle kerb Weight
- Emission Certificate Level

Sources of fuel economy/ Co₂ Emissions data

- Car Co₂ Emissions (UK) http://car-emissions.com
- US Environmental Protection Agency- http://www.fueleconomy.gov
- Car Fuel Data, Co₂ and Vehicle Tax Tools http://carfuel.data.direct.gov.uk
- World car specifications –
 http://www.carfolio.com/specification

Data Source based on -

- New European Drive Cycle (NEDC)
- Japanese tests cycles (JCO8)

Vehicle Population for data Inventory (Phase 1)

(1) LDVs imported in 2005 and 2013

	2005	2013
New Vehicles	5,221	8,342
Second Hand Vehicles	5,312	7,512
Total	10,553	15,854

(2) Cumulative Total LDVs

	2005	2013
New Vehicles	104,314	159,289
Second Hand Vehicles	37,272	81,741
Total	141,586	241,030

(3) Fuel economy and Co² emissions data sought for 127 makes/model clusters. The process will be described under the Chapter Data Entry Tool.

Breakdown of Cumulative of LDVs Fleet by fuel Type

Year	Petrol	Diesel	LPG	LPG + PETROL	Hybrid	Total
2005	98,740	42,618	209	15	4	141,586
2006	106,377	45,309	209	18	5	151,918
2007	114,531	48,108	210	20	5	162,874
2008	124,804	51,095	212	20	9	176,140
2009	133,795	53,486	213	25	55	187,574
2010	142,891	56,014	216	28	180	199,329
2011	151,822	58,463	218	28	337	210,868
2012	163,102	61,096	219	28	731	225,176
2013	175,915	63,446	223	28	1,418	241,030

Average fuel consumption and Co₂ emissions for LDVs registered in 2005 and 2013

Year	Average Fuel Consumption (L/100km)	Average CO ₂ Emission (g/km)
2005	7	186
2013	6.6	169

Phase 2

 Vehicles inventory covers all vehicles registered in 2014 and 2015

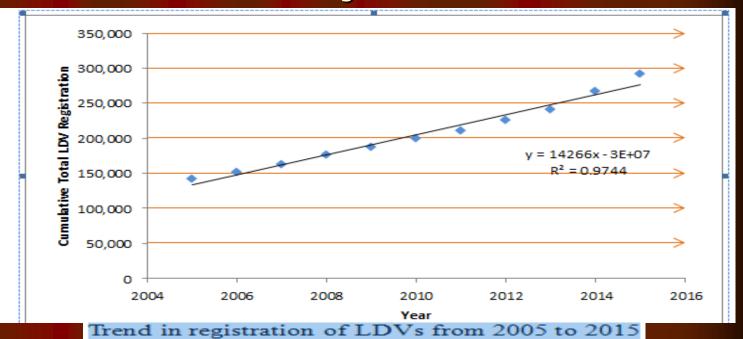
LDVs include two-wheelers

 Inventory includes HDVs as well but these are assessed separately from LDVs

Vehicles registered in 2014 and 2015

	2014	2015
New Vehicles	18,844	16,122
Second Hand Vehicles	7,556	9,891
Total	26,400	26,013

Trend in LDVs registration 2005 - 2015



Cumulative LDVs Estimates for Year 2030 and 2050

Year	Cumulative Total LDVs Estimates
2005	141,586
2015	292,385
2030	490,390
2050	775,720

On the basis of the best line of fit, it is forecast that the number of LDV registered in 2030 will be almost $500,000 \ (+67\%)$ and $775000 \ (+165\%)$ in 2050 under a Business As Usual (BAU) scenario

Missing Fields Number of vehicles for which data on fuel consumption and Co₂ emissions not obtained

Number of missing fields for LDVs and HDVs registered in 2014 and 2015				
Year	LDVs	HDVs	Total	
2014	7	57	64 (0.24 %)	
2015	0	26	26 (0.09 %)	

LDVs and HDVs by class of Vehicle

	2014	2015
Total Vehicles registered	26,400	26,013
Number of LDVs	25,759(97.6%)	25,596(98.4%)
Number of HDVs	641(2.4%)	417 (1.6%)

Number of LDVs and HDVs by fuel type

Year	Type of Vehicles	Petrol	Diesel	Hybrid	Electric	LPG	Total
	All	22,219	3,742	436	2	1	26,400
2014	LDVs	22,215	3,106	435	2	1	25,759
	HDVs	4	636	1	0	0	641
	All	22,805	2,608	588	11	1	26,013
2015	LDVs	22,802	2,195	587	11	1	25,596
	HDVs	3	413	1	0	0	417

- Petrol driven vehicles constitute the vast majority
- Noteworthy increase in number of hybrid vehicles (from 55 in 2009 to 5,500 in 2017)

Average fuel consumption and Co₂ emission for all vehicles registered in 2014 and 2015

	Average Fuel Consumption (l/100 km)	Average CO ₂ Emissions (g/km)
2014	6.2	155
2015	6.2	153

 Although Inventory not for same vehicle fleet mix as that for Phase I, the average fuel consumption and Co₂ emission shows a decrease from 7 L/100 Km in 2005 to 6.2L/100 km in 2015 and 186 g/km of Co₂ emission to 153 g/km respectively.

Fuel economy and Co₂ emission comparison for new and second hand vehicles 2014 and 2015

Year	Vehicle	Co	verage Fu onsumpti l/100 km	ion	Average CO ₂ Emissions (g/km)					
	Type	All	New	Second Hand	All	New	Second Hand			
	LDVs	5.8	5.5	6.7	145	137	165			
2014	HDVs	21.5	20.9	24.6	612	593	695			
	LDVs	5.9	5.5	6.5	146	138	158			
2015	HDVs	22.7	22.5	24.7	645	640	687			

 Second hand vehicles consume almost 20% more fuel than new vehicles and emit 15% more Co₂ (LDVs)

Fuel economy and Co₂ emmission by fuel type

		Average (Fuel Co /100		Average CO ₂ Emissions (g/km)						
Year	Vehicle Type	Petrol powered	Diesel powered	Hybrid	LPG powered	Petrol powered	Diesel powered	Hybrid	LPG		
2014	LDVs	5.7	7.0	4.2	4.2	142 174		102	99		
2014	HDVs	32.7	21.5	10.4	0	927	611	0	0		
2015	LDVs	5.9	6.9	4.0	6.6	145	168	95	163		
	HDVs	0	22.8	0	0	0	646	0	0		

 Highlights boldly the low fuel consumption of hybrid LDVs and low Co₂ emissions – 4 L/100 km and 95 g/km more Co₂ in 2015

Fuel Economy and Co₂ emissions by engine displacement

		2014		2015						
	Number of Vehicles	Average Fuel Consumption (l/100 km)	Average CO ₂ Emissions (g/km)	Number of Vehicles	Average Fuel Consumption (l/100 km)	Average CO ₂ Emissions (g/km)				
≤ 100	2629	3.0	79	1954	3.2	83				
101-500	6798	5.1	131	6120	5.1	130				
501-1000	1607	6.3	153	3137	6.4	157				
1001-1500	9008	6.6	162	9086	6.3	155				
1501-2000	3339	6.8	164	3296	6.8	164				
2001-2500	1421	7.7	189	1536	7.1	177				
2501-3000	654	8.1	205	425	7.8	194				
3001-3500	250	8.4	205	14	8.0	201				
3501-4000	116	12.5	339	58	9.2	233				
4001-5000	152	18.2	510	134	20.5	578				
5001-10000	320	22.0	625	165	22.5	647				
>10000	45	35.3	1000	51	32.8	920				

- Reveals valuable information on consumer's choice
- Mainly for two-wheelers of 101-500 cc
 - cars of 1001 1500 cc
 - Decline in number of vehicles of 3000 cc or more
 - Improvement in fuel consumption and Co_2 emission of vehicles in the range 1001 1500 cc

The need for a breakdown of inventory data

- Vehicle registration data has been worked out
 - by class of vehicle
 - by class subdivided into HDVs and LDVs
 - by fuel type
 - by engine technology
- Fuel economy and Co₂ Emission have been detailed
 - by class of vehicle registered
 - by new and second hand vehicle
 - by fuel type both for LDVs and HDVs
 - by engine displacement
 - by engine displacement and fuel type

The need for a breakdown of inventory data

- It enables development and implementation of targeted policies/strategies to promote fuel economy and Co₂ abatement.
- It enables influencing consumer choice towards vehicles with higher fuel economy and lower Co₂ emission through public information/fiscal incentives.
- Breakdown of Inventory data reveals important information as to which segment of vehicle population has the maximum potential for fuel economy and Co₂ emission reduction.
- It reduces the country's reliance on fossil fuels and expenditure on importation of such fuels.
- It enables the country to reap environmental benefits through lesser Co₂ emissions

Trend of fuel economy and Co₂ Emissions 2005 – 2015 LDVs

	2005	2013	2015
Fuel Economy L/100 Km)	7.0	6.6	5.9
Co ₂ Emission (g/km)	186	169	145

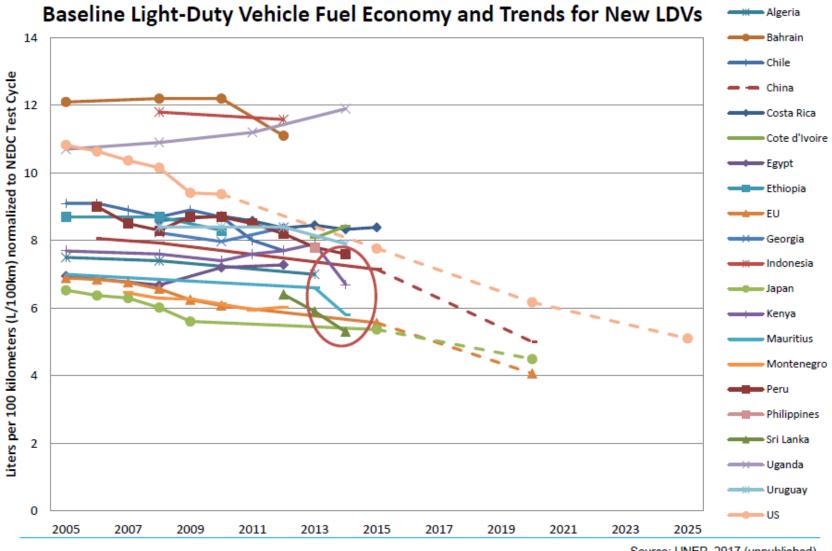
All vehicles (2015) – 6.2L/100 km and 153 g/km

Comparison of fuel economy with global average (LDV only) (L/100 km)

	2005	2008	2011	2013	2014
Global Average	8.07	7.67	7.2	7.1	-
OECD Average	8.1	7.6	7.0	6.9	-
Non OECD Average	7.8	7.6	7.5	7.2	-
Mauritius	7.0	-	-	6.6	5.8

Source GFEI presentation (Malawi)

Fuel economy policies can work substantially

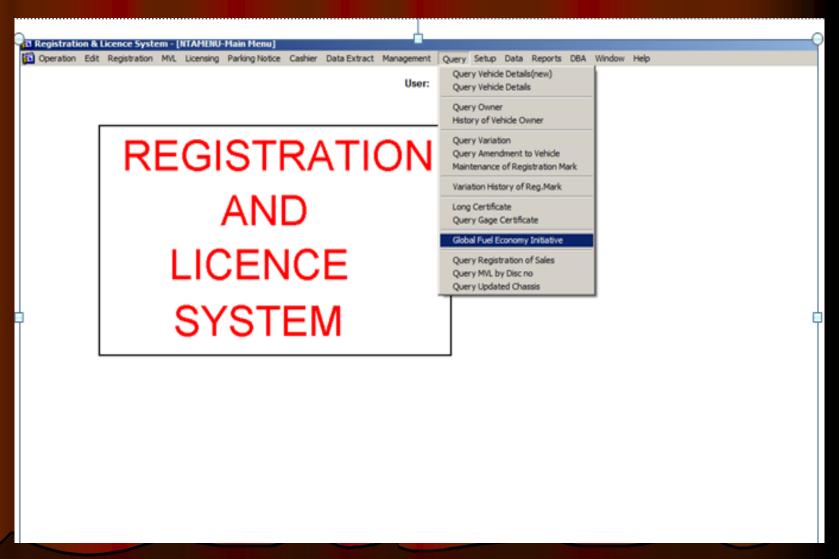


Development of a Data Entry Tool

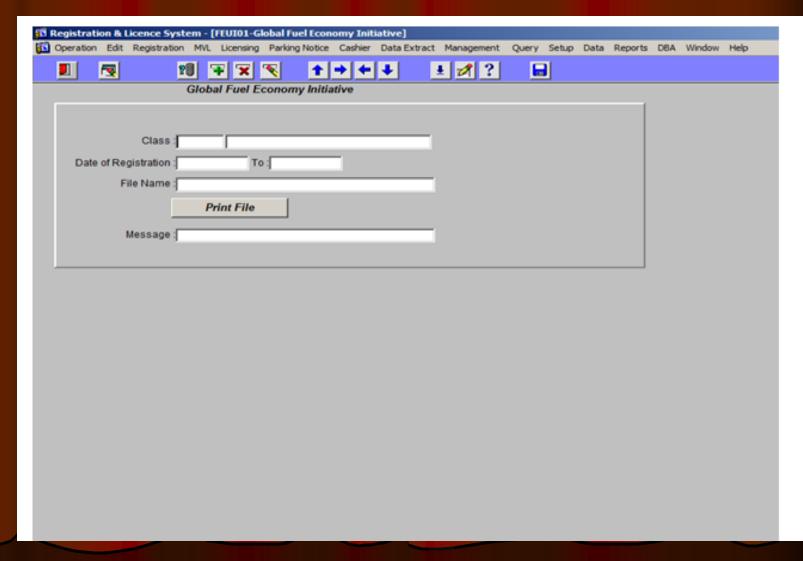
- NTA database provides detailed information on all vehicles registered
- During Phase 1 of the Inventory –
- Additional function developed in vehicle registration software in format required for GFEI inventory
- This function enable the registered vehicles to be clustered by make, model, engine capacity, Country of origin, new or second hand, fuel type etc.
- > This information was generated on MS Excel
- Fuel Economy and Co₂ Emission data were sought for each cluster of vehicles to constitute the Inventory

THE PROCESS STEPWISE

Step 1: On the <u>Registration and Licence System</u> menu of the vehicle registration system, go to the <u>Query</u> tab and click on <u>Global Fuel Economy Initiative</u> from the dropdown row.

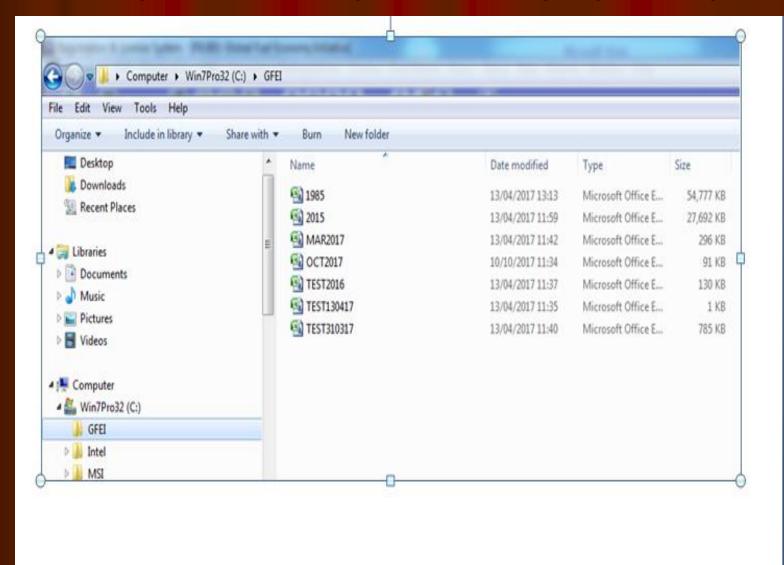


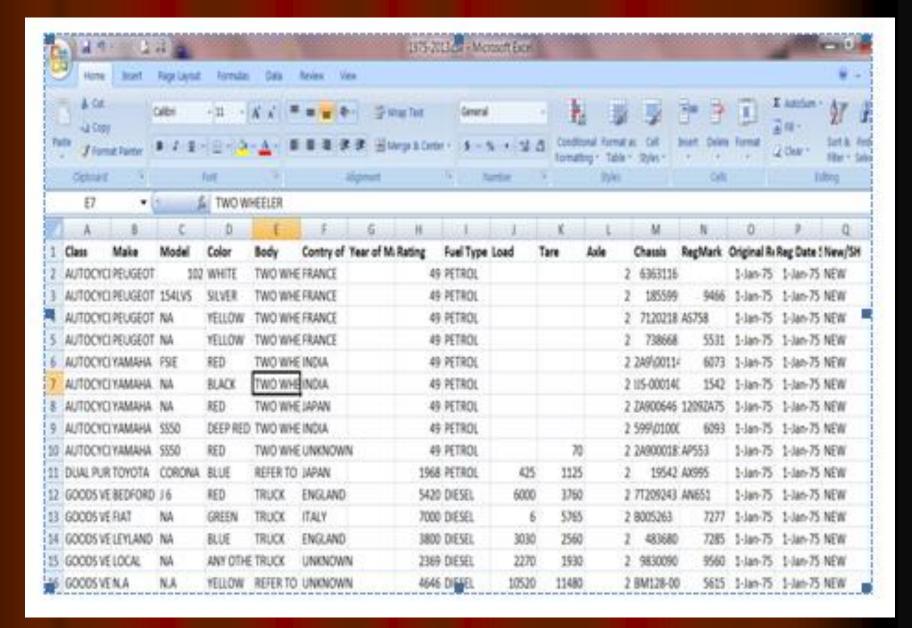
Step 2: Once in the <u>Global Fuel Economy Initiative</u> menu, type in the <u>Class</u> of vehicle and the year bracket on the <u>Date of Registration</u> fields.



Global Fuel Economy Initiative menu within the NTA vehicle registration system

Step 3: Click on the <u>File Name</u> field to open the <u>GFEI folder</u> to select the required Common Separated Values (CSV) file and year bracket





Sample vehicle data stored within CSV file of 1975-2013. The CSV files store tabular data for all types of vehicles as shown above. It is noted that fuel consumption and CO₂ emission fields are missing.

Step 4: Once the selected CSV file is imported in the DET software, press the <u>Print File</u> button on the <u>Global Fuel Economy Initiative</u> menu at Step 2. This will generate the vehicle data sheet in MS Excel as shown below.

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ğ	A	1	C	0	E	1.	6	H	-	1	K	L	M	N	0	9
1	Class	Make	Model	Color	Body	Contry of	Year of 1	A Rating	Fuel Type	Load	Tare	Asle	Chassis	RegMark	Original Reg Date	Reg Date 5 Ne
2	AUTOCYC	PEUGEOT	102	WHITE	TWO WHE	FRANCE		49	PETROL			- 1	6363116		1-lan-75	1-Jan-75 NE
3	AUTOCYC	PEUGEOT	1541.75	SILVER	TWO WHE	FRANCE		49	PETROL			- 1	185599	9466	1-Jan-75	1-Jan-75 NE
	AUTOCYC	PEUGEOT	NA.	YELLOW	TWO WHE	FRANCE		49	PETROL			1	7120218	A5758	1-lan-75	1-lan-75 No
5	AUTOCYC	PEUGEOT	NA.	YELLOW	TWO WHE	FRANCE		49	PETROL			- 2	738668	5531	1-lan-75	1-Jan-75 NE
6	AUTOCYC	AHAMAYE	FSIE	RED	TWO WHE	INDIA		49	PETROL			7	249\0011	6073	1-lan-75	1-Jan-75 NE
7	AUTOCYC	TYAMAHA	NA.	BLACK	TWO WHE	NOA		49	PETROL			- 2	US-00014	1542	1-lan-75	1-Jan-75 NE
8	AUTOCYC	EYAMAHA	NA.	RED	TWO WHE	JAPAN		49	PETROL			2	ZA900646	1209ZA75	1-lan-75	1-Jan-75 NE
9	AUTOCYC	AHAMAYE	5550	DEEP RED	TWO WHE	NOA		49	PETROL			- 7	599\0100	6093	1-lan-75	1-Jan-75 NE
10	AUTOCYC	EXAMAHA	9550	RED	TWO WHE	UNKNOW	N:	49	PETROL		70	- 7	2A900018	AP553	1-Jan-75	1-Jan-75 NE
11	DUAL PUR	ATOYOTA	CORONA	BLUE	REFER TO	JAPAN		1968	PETROL	425	1125	- 7	19542	AX995	1-lan-75	1-Jan-75 NE
12	G0005 V	E BEDFORD	16	RED	TRUCK	ENGLAND	į.	5420	DIESEL	6000	3760	1	77209243	AN651	1-Jan-75	1-Jan-75 NE
13	G0005 V	ERIAT	NA.	GREEN	TRUCK	ITALY		7000	DIESEL	- 6	5765	1	8005263	7277	1-lan-75	1-lan-75 NE
14	G0005 V	ELEYLAND	NA.	BLUE	TRUCK	ENGLAND		3800	DIESEL	3030	2560	1	483680	7285	1-lan-75	1-Jan-75 NE
15	60005 V	ELOCAL	NA.	ANY OTHE	TRUCK	UNKNOW	N	2369	DIESEL	2270	1930		9830090	9560	1-lan-75	1-Jan-75 NE
16	G0005 V	EN.A	N.A	YELLOW	REFER TO	UNKNOW	N	4646	DISSEL	10520	11480	1	BM128-00	5615	1-lan-75	1-Jan-75 No

Sample of data collected after extracting into MS Excel format.

Sample of registration data for vehicles

Class	Make	Model	Color -	*	Contry of Manufactur e	Rating	MGW (Kg)_	Reg Date	Conditio	Fuel Type	Load *	Tare _±	Axle	Chassi S _∗	RegMar k	Keg	Pivot groupin;	No of Vehicles	CO: Emission (g/Km)	Fuel Consumption (L/100Km)
AUTOCYCLE	AP RILIA	RS 50	YELLOW / GREY	TWO WHEELER	ITALY	50	89	2002	S/H	PETROL		89	2	00150285	4116AZ	15-Jun-15	1	1		
AUTOCYCLE	AP RILIA	SX50	WHITE	TWO WHEELER	ITALY	50	101	2015	NEW	PETROL		101	2	1G013FS1	6565AA	10-Nev-15	3	1	60.3	2.1
AUTOCYCLE	ARDOUR	JJ50QT-23	BLUE	TWO WHEELER	CHINA	50	90	2015	NEW	PETROL		90	2	I ROSDIE	6402AA	30-Oe+15	1	1	1442	5.8
AUTOCYCLE	BAOTIAN	BT49QT-12CE3	ORANGE & BLACK	TWO WHEELER	CHINA	49	90	2015	NEW	PETROL		90	2	APC2E12	3663AA	4-Jun-15	12	1	1442	5.8
AUTOCYCLE	BAOTIAN	BT50-2	BLACK	TWO WHEELER	CHINA	50	90	2015	NEW	PETROL		90	2	2E+09	4883AA	31-Jul-15	1	1	1442	5.8
AUTOCYCLE	CYGNET 2	SCOOTER	BLUE	TWO WHEELER	CHINA	50	103	2015	NEW	PETROL		103	2	CID16EIG	1155AA	13-Fdb-15	1	1		
AUTOCYCLE		STM 50	BLACK	TWO WHEELER	CHINA	50	100	2015	NEW	PETROL		100	2	21 C9EU(40AA	5-lan-15	1	1	1442	5.8
AUTOCYCLE	DAYANG	DY50QT	RED	TWO WHEELER	CHINA	49	83	2015	NEW	PETROL		83	2	BPY1811		20-Jul-15	1	i		
AUTOCYCLE	DAYANG	DYSOQT-8	RED	TWO WHEELER	CHINA	49	83	2015	NEW	PETROL		83	2	BPY3811			2	1		
AUTOCYCLE	DELTA	AVATAR 50	BLACK	TWO WHEELER	CHINA	50	άb	2015	NEW	PETROL		88	2	TBLA0140	91AA	6-Jan-15	10	i	144	5.8
AUTOCYCLE	DELTA	DT90	BLUE	TWO WHEELER	CHINA	50	78	2015	NEW	PETROL		78	2	A2014080	85AA	6-Jan-15	7	i	144	5.8
AUTOCYCLE		DT90-6F	RED	TWO WHEELER	CHINA	50	88	2015	NEW	PETROL		88	2	BLA6EB4	148AA	7-lan-15	45	i	144	5.8
AUTOCYCLE	DELTA	LUCAS 90	BLUE	TWO WHEELER	CHINA	50	88	2015	NEW	PETROL		88	2	'B166ER4	306AA	12-Jan-15	6	i	144	5.8
AUTOCYCLE	DELTA	NICE 50	BLACK	TWO WHEELER	CHINA	50	88	2015	NEW	PETROL		88	2	CBL07E00	SSAA	6-lan-15	78	1	144	5.8
AUTOCYCLE	DELTA	Ø30	BLUE	TWO WHEELER	CHINA	50	78	2015	NEW	PETROL		78	2	A2014080	71AA	5-lan-15	44	1	144	5.8
AUTOCYCLE	DELTA	R58-50	BLACK	TWO WHEELER	CHINA	50	88	2015	NEW	PETROL		88	2	B420DR	149AA	7-Inn-15	5	1	144	5.8
AUTOCYCLE	DELTA	YAMA 50	ORANGE	TWO WHEELER	CHINA	50	88	2015	NEW	PETROL		88	2	GS11ER4	775AA	28-Jan-15	4	1	144	5.8
AUTOCYCLE	DERBI	BOULEVARD 50	BLACK	TWO WHEELER	CHINA	49	90	2015	NEW	PETROL		90	2	RIALAE4	693.AA	26-Jan-15	24	1	55.6	2
AUTOCYCLE	DERBI	BOULEVARDNM50	BLACK	TWO WHEELER	CHINA	50	90	2015	NEW	PETROL		90	2	NAIAC4	98AA	7-lan-15	1	i	55.6	2
AUTOCYCLE		SENDA SM XTREM 50	BLACK	TWO WHEELER	CHINA	50	90	2015	NEW	PETROL		90	2	BBOL9ES(1441.AA	27-Feb-15	1	1	55.6	2
AUTOCYCLE	DERBI	SENDA XTREM 50 SM	BLACK	TWO WHEELER	ITALY	50	90	2015	NEW	PETROL		90	2	BB010ES0	7148AA	14-Dec-15	1	i	55.6	2
AUTOCYCLE	DERBI	IENDA XTREME 5033	BLACK	TWO WHEELER	ITALY	50	90	2015	NEW	PETROL		90	2	BB010ES4	5970AA	6-0et-15	2	i	55.6	2
AUTOCYCLE	FERANO	FK 90-3F	BLACK	TWO WHEELER	CHINA	50	105	2015	NEW	PETROL		105	2	BLA3FB4	5020AA	10-Aug-15	18	1	144.2	5.8
AUTOCYCLE		FK 50-8F	SILVER	TWO WHEELER	CHINA	50	105	2015	NEW	PETROL		105	2	BLB6EB	455.AA	16-Jan-15	15	i	144.2	5.8
AUTOCYCLE		FORZA 50	BLACK	TWO WHEELER	CHINA	50	90	2015	NEW	PETROL		90	2	CALF9F0	4985AA	7-Aug-15	5	1	1442	5.8

Further Enhancement of Software

- The date entry tool is being further enhanced
- Two additional fields are being provided one for fuel economy and one for Co₂ Emissions.
- Vehicle importers and dealers to supply mandatorily fuel economy and Co₂ Emission data for all new and second hand vehicles being registered for first time in Mauritius.
- Information keyed in when vehicle being registered
- Software also being enhanced to capture in-use vehicle emission data from periodic vehicle roadworthiness test.
- Accurate fuel economy Co₂ emission data available both for vehicle inventory and other climate change reporting needs.

THANK YOU