

APPLICATION OF AIM/ENDUSE TO MALAYSIA: AN INITIAL ASSESSMENT

By

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Initial investigation focused on:

- 1) Transport sector
- 2) Residential sector

Transport Sector:

- a) Emphasis on road transport
- b) Information on rail transport; just received, but too late to present in this workshop
- c) Water and air transport: no response yet
- d) Road transport includes cars, buses, lorries, motorcycles etc.
- e) Vehicle population: base year-2000; projection year-2010

Residential Sector:

- a) Survey involving 1,200 households were carried out
- b) Households were divided into “rural” and “urban”, but division is not clear-cut
- c) Main usage:
 - i) cooking
 - ii) lighting
 - iii) others e.g. washing, refrigeration
- d) Base year – 2000 ; Projection year-2010

SERVICE CLASSIFICATION TRANSPORT SECTOR

No.	Service Code	Service Name	Service Unit	Sector Name
1	TPRC	Passenger car transportation	1000 p.km	Road
2	TPRM	Passenger motorcycle transportation	1000 p.km	Road
3	TPRT	Passenger taxi transportation	1000 p.km	Road
4	TPRB	Passenger bus transportation	1000 p.km	Road
5	TPRL	Passenger lorry transportation	1000 p.km	Road
6	TOTH	Others transportation	1000 p.km	Non-specified Transport

SERVICE CLASSIFICATION

RESIDENTIAL SECTOR

No.	Service Code	Service Name	Service Unit	Sector Name
1	RLGT	Res-Lighting (Bulb 25 W)	m hh-hrs	Residential
2	RL	Res-Lighting (Bulb 40 W)	m hh-hrs	Residential
3	RLB	Res-Lighting (Bulb 60 W)	m hh-hrs	Residential
4	RLU	Res-Lighting (Bulb 100 W)	m hh-hrs	Residential
5	RFL	Res-Lighting (Fluorescent 28 W)	m hh-hrs	Residential
6	RFU	Res-Lighting (Fluorescent 32 W)	m hh-hrs	Residential
7	RFR	Res-Lighting (Fluorescent 40 W)	m hh-hrs	Residential
8	RFE	Res-Lighting (Fluorescent 100 W)	m hh-hrs	Residential
9	RCG	Res-Cooking (Gas)	m hh-hrs	Residential
10	RCKG	Res-Cooking (Electricity)	m hh-hrs	Residential

11	RFAN	Ceiling fan	1000 unit	Residential
12	RFA	Stand fan	1000 unit	Residential
13	RRC	Rice cooker	1000 unit	Residential
14	RMI	Mixer	1000 unit	Residential
15	RTS	Toaster	1000 unit	Residential
16	RKT	Electric kettle	1000 unit	Residential
17	RWM	Washing machine	1000 unit	Residential
18	RI	Iron	1000 unit	Residential
19	RWH	Water heater	1000 unit	Residential
20	RR	Refrigerator	1000 unit	Residential

21	RTV	TV Color	1000 unit	Residential
22	RBW	Black and White TV	1000 unit	Residential
23	RRA	Radio	1000 unit	Residential
24	RCD	VCD	1000 unit	Residential
25	RHF	HiFi	1000 unit	Residential
26	RAC	Air-Conditioner (1 HP)	1000 unit	Residential
27	RAO	Air-Conditioner (1.5 HP)	1000 unit	Residential
28	RAN	Air-Conditioner (2 HP)	1000 unit	Residential
29	RVC	Vacuum cleaner	1000 unit	Residential
30	RCR	Clothes drier	1000 unit	Residential
31	RHD	Hair drier	1000 unit	Residential
32	RC	Others (Computer)	1000 unit	Residential

SERVICE DEMAND TRANSPORT SECTOR

<i>No.</i>	<i>Service</i>	<i>Year 1</i>	<i>Value</i>	<i>Year 2</i>	<i>Value</i>
1	Passenger car transportation (1000 p.km)	2000	80,100,372	2010	199,300,193
2	Passenger motorcycle transportation (1000 p.km)	2000	60,368,927	2010	93,946,765
3	Passenger taxi transportation (1000 p.km)	2000	6,432,111	2010	7,032,866
4	Passenger bus transportation (1000 p.km)	2000	5,092,478	2010	6,224,477
5	Passenger lorry transportation (1000 p.km)	2000	32,133,217	2010	45,399,440
6	Others transportation (1000 p.km)	2000	15,247,682	2010	23,629,374

SERVICE DEMAND-RESIDENTIAL SECTOR

No.	Service	Year 1	Value	Year 2	Value
1	Res-Lighting (Bulb 25 W) (m hh-hrs)	2000	1,765.89	2010	2,194.91
2	Res-Lighting (Bulb 40 W) (m hh-hrs)	2000	2,260.98	2010	2,810.28
3	Res-Lighting (Bulb 60 W) (m hh-hrs)	2000	1,052.85	2010	1,308.64
4	Res-Lighting (Bulb 100 W) (m hh-hrs)	2000	243.14	2010	302.21
5	Res-Lighting (Fluorescent 28 W) (m hh-hrs)	2000	2,979.03	2010	3,702.78
6	Res-Lighting (Fluorescent 32 W) (m hh-hrs)	2000	26,236.54	2010	32,610.71
7	Res-Lighting (Fluorescent 40 W) (m hh-hrs)	2000	10,570.04	2010	13,138.03

8	Res-Lighting (Fluorescent 100 W) (m hh-hrs)	2000	1,646.56	2010	2,046.59
9	Res-Cooking (Gas) (m hh-hrs)	2000	1,281.47	2010	1,592.80
10	Res-Cooking (Electricity) (m hh-hrs)	2000	535.54	2010	665.65
11	Ceiling fan (10 ³)	2000	9,134.31	2010	11,353.50
12	Stand fan (10 ³)	2000	7,714.24	2010	9,588.41
13	Rice cooker (10 ³)	2000	4,833.16	2010	6,007.38
14	Mixer (10 ³)	2000	2,786.95	2010	3,464.04
15	Toaster (10 ³)	2000	1,530.57	2010	1,902.42

16	Electric kettle (10 ³)	2000	2,520.94	2010	3,133.40
17	Washing machine (10 ³)	2000	3,781.41	2010	4,700.10
18	Iron (10 ³)	2000	3,605.43	2010	4,481.38
19	Water heater (10 ³)	2000	1,555.12	2010	1,932.94
20	Refrigerator (10 ³)	2000	4,755.41	2010	5,910.74
21	TV Color (10 ³)	2000	5,753.96	2010	7,151.89
22	Black and White TV (10 ³)	2000	245.55	2010	305.20
23	Radio (10 ³)	2000	3,298.50	2010	4099.87
24	VCD (10 ³)	2000	2,615.07	2010	3,250.40

25	HiFi (10 ³)	2000	1,898.89	2010	2,360.22
26	Air-Conditioner (1 HP) (10 ³)	2000	1,776.12	2010	2,207.62
27	Air-Conditioner (1.5 HP) (10 ³)	2000	376.50	2010	467.98
28	Air-Conditioner (2 HP) (10 ³)	2000	143.24	2010	178.03
29	Vacuum cleaner (10 ³)	2000	1,354.60	2010	1,683.69
30	Clothes drier (10 ³)	2000	151.42	2010	188.21
31	Hair drier (10 ³)	2000	1,141.79	2010	1,419.19
32	Others (Computer) (10 ³)	2000	3,834.03	2010	4,765.51

ENERGY DEVICE DATA-TRANSPORT SECTOR

Device	Device unit	Life (yr.)	Fixed cost US\$/d.u.	Service	Service unit	Specific Service Output (Service unit/d.u./yr)	Energy	Specific energy Input (GJ/d.u./yr)	NOx factor (kg-NOx/d.u./yr.)
Car	1 unit	7	19,737	R.P.	1000 p.km	38.64	Gasoline	53.75	10.3
Motor cycle	1 unit	7	1,053	R.P.	1000 p.km	22.54	Gasoline	21.1	0.07
Taxi	1 unit	7	14,474	R.P.	1000 p.km	386.4	Gasoline	268.78	10.3
Bus	1 unit	7	39,474	R.P.	1000 p.km	4604.6	Diesel	426.39	52
Lorry	1 unit	7	23,684	R.P.	1000 p.km	96.6	Diesel	196.79	52
Others	1 unit	7	25,000	R.P.	1000 p.km	96.6	Diesel	196.79	52

P : Road Passenger

ENERGY DEVICE DATA-RESIDENTIAL SECTOR

Device	D .u.	L. yr.	Fixed cost US\$/d.u.	Service	Service unit	Specific Service Output (Service unit/d.u./yr)	Energy	Specific energy input (GJ/d.u./yr)	NOx factor (kg-NOx/d.u./yr.)
Bulb (25W)	1 unit	1	0.39	Lighting	m.hh. hrs	443.48	Electricity	0.04	0
Bulb (40W)	1 unit	1	0.39	Lighting	m.hh. hrs	471.39	Electricity	0.07	0
Bulb (60W)	1 unit	1	0.39	Lighting	m.hh. hrs	383.98	Electricity	0.08	0
Bulb (100W)	1 unit	1	0.39	Lighting	m.hh. hrs	165.49	Electricity	0.06	0
Fluorescent (28W)	1 unit	1	1.26	Lighting	m.hh. hrs	775.22	Electricity	0.08	0
Fluorescent (32W)	1 unit	1	1.26	Lighting	m.hh. hrs	2955.73	Electricity	0.34	0

D.u = Device Unit; L. = Life; yr. = Year

Fluorescent (40W)	1 unit	1	1.26	Lighting	m.hh. hrs	1000.32	Electricity	0.14	0
Fluorescent (60W)	1 unit	1	1.26	Lighting	m.hh. hrs	357.96	Electricity	0.07	0
Gas stove	1 stove	1	3.95	Cook	toe	0.144	LPG	7.24	0
Electricity stove	1 stove	1	526.1	Cook	1 unit	1	Electricity	1.44	0
Ceiling fan	1 fan	7	33.95	Fan	1 unit	1	Electricity	1.04	0
Stand fan	1 fan	7	44.47	Fan	1 unit	1	Electricity	0.57	0

Rice cooker	1 r/c	7	41.84	Rice cooker	1 unit	1	Electricity	1.64	0
Mixer	1 m	7	35.79	Mixer	1 unit	1	Electricity	0.18	0
Toaster	1 toast	7	23.42	Toaster	1 unit	1	Electricity	0.35	0
Electric kettle	1 e/k	7	23.16	Electric kettle	1 unit	1	Electricity	3.39	0
Washing machine	1 w/m	7	197.1	W/m	1 unit	1	Electricity	1.09	0
Iron	1 iron	7	13.42	Iron	1 unit	1	Electricity	1.26	0
Water heater	1 w/h	7	102.4	Water heater	1 unit	1	Electricity	3.33	0

Refrigerator	1 ref.	7	736.6	Refrigerator	1 unit	1	Electricity	5.20	0
TV Color	1 tv	7	473.2	TV Color	1 unit	1	Electricity	0.99	0
Black and White TV	1 tv	7	78.68	Black and White TV	1 unit	1	Electricity	0.02	0
Radio	1 radio	7	102.1	Radio	1 unit	1	Electricity	0.07	0
VCD	1 vcd	7	391.6	VCD	1 unit	1	Electricity	0.27	0
HiFi	1 hifi	7	496.8	HiFi	1 unit	1	Electricity	21.02	0
Air-Conditioner (1 HP)	1 a/c	7	389.5	Air-Con (1 HP)	1 unit	1	Electricity	1.88	0


Air-Conditioner (1.5 HP)	1 a/c	7	389.5	Air-Con(1.5 HP)	1 unit	1	Electricity	1.05	0
Air-Conditioner (2 HP)	1 a/c	7	888.2	Air-Con (2 HP)	1 unit	1	Electricity	0.90	0
Vacuum cleaner	1 v/c	7	73.42	V /c	1 unit	1	Electricity	0.99	0
Clothes drier	1 c/ drier	7	278.7	Clothes drier	1 unit	1	Electricity	0.28	0
Hair drier	1 hair drier	7	20.79	Hair drier	1 unit	1	Electricity	0.43	0
Others (Computer)	1 com	7	815.5	Others	1 unit	1	Electricity	0.75	0

STOCK DATA-TRANSPORT SECTOR

No.	Energy Device	Stock	Specific Service (/year/device unit)	Specific Energy Consumption (GJ/year/device unit)	NO _x factor (kg-NO _x /d.u./yr.)
1	Car	4,145,982	38.64	53.63	10.3
2	Motorcycle	5,356,604	22.54	21.10	0.07
3	Taxi	66,585	386.4	268.6	10.3
4	Bus	48,662	4604.6	426.24	52
5	Lorry	665,284	96.6	426.23	52
6	Others	336,555	96.6	426.23	52

STOCK DATA-RESIDENTIAL SECTOR

<i>No.</i>	<i>Energy Device</i>	<i>Stock</i>	<i>Specific Service (/year/device unit)</i>	<i>Specific Energy Consumption (GJ/year/device unit)</i>	<i>NOx factor (kg- NOx/d.u./yr.)</i>
1	Bulb (25W)	3,981,938	443.48	0.04	0
2	Bulb (40W)	4,796,333	471.39	0.07	0
3	Bulb (60W)	2,741,931	383.98	0.08	0
4	Bulb (100W)	1,469,184	165.49	0.06	0
5	Fluorescent (28W)	3,842,796	775.22	0.08	0
6	Fluorescent (32W)	8,876,490	2955.73	0.34	0
7	Fluorescent (40W)	10,566,665	1000.32	0.14	0
8	Fluorescent (60W)	4,599,896	357.96	0.07	0



9	Gas stove	4,661,283	0.144	7.24	0
10	Electricity stove	1,947,999	1	1.44	0
11	Ceiling fan	9,134,313	1	1.04	0
12	Stand fan	7,714,238	1	0.57	0
13	Rice cooker	4,833,165	1	1.64	0
14	Mixer	2,786,948	1	0.18	0
15	Toaster	1,530,570	1	0.35	0

16	Electric kettle	2,520,939	1	3.39	0
17	Washing machine	3,781,409	1	1.09	0
18	Iron	3,605,435	1	1.26	0
19	Water heater	1,555,125	1	3.33	0
20	Refrigerator	4,755,409	1	5.20	0
21	TV Color	5,753,962	1	0.99	0
22	Black and White TV	245,546	1	0.02	0
23	Radio	3,298,502	1	0.07	0
24	VCD	2,615,065	1	0.27	0

25	HiFi	1,898,889	1	21.02	0
26	Air-Conditioner (1 HP)	1,776,116	1	1.88	0
27	Air-Conditioner (1.5 HP)	376,503	1	1.05	0
28	Air-Conditioner (2 HP)	143,235	1	0.90	0
29	Vacuum cleaner	1,354,596	1	0.99	0
30	Clothes drier	151,420	1	0.28	0
31	Hair drier	1,141,789	1	0.43	0
32	Others (Computer)	3,834,030	1	0.75	0

Figure 1. Total CO₂ & NO_x emissions from the transport sector (2000-2010)

LPS_Area (All) LPS (All) Region MYS Removal NON Kind EMS Energy_Device (All) Sector TR-ROA

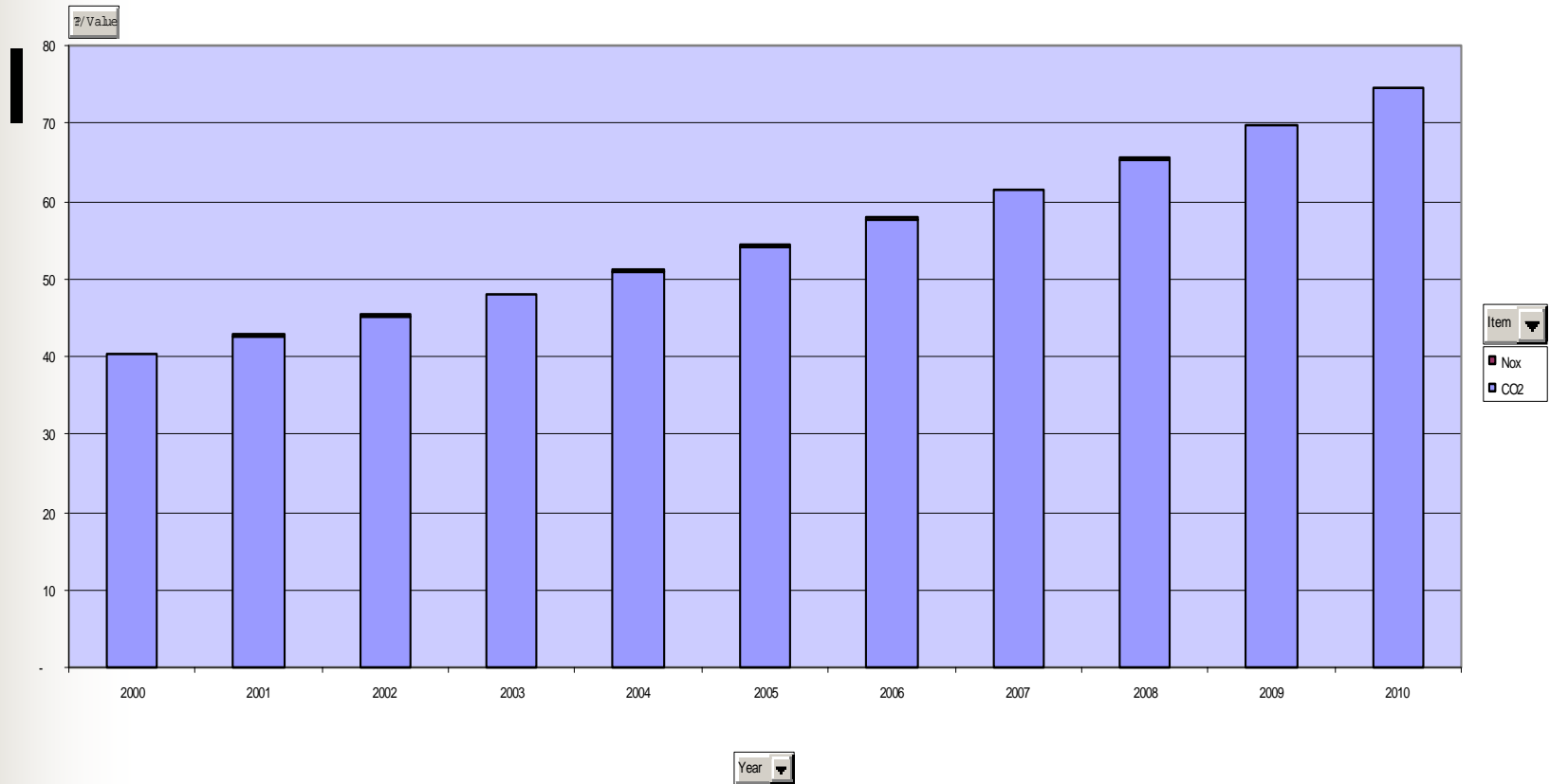


Figure 2. Energy Consumption (Gasoline and Diesel)

LPS_Area (All) LPS (All) Region MYS Removal NON Kind ENG Energy_Device (All) Sector TR-ROA

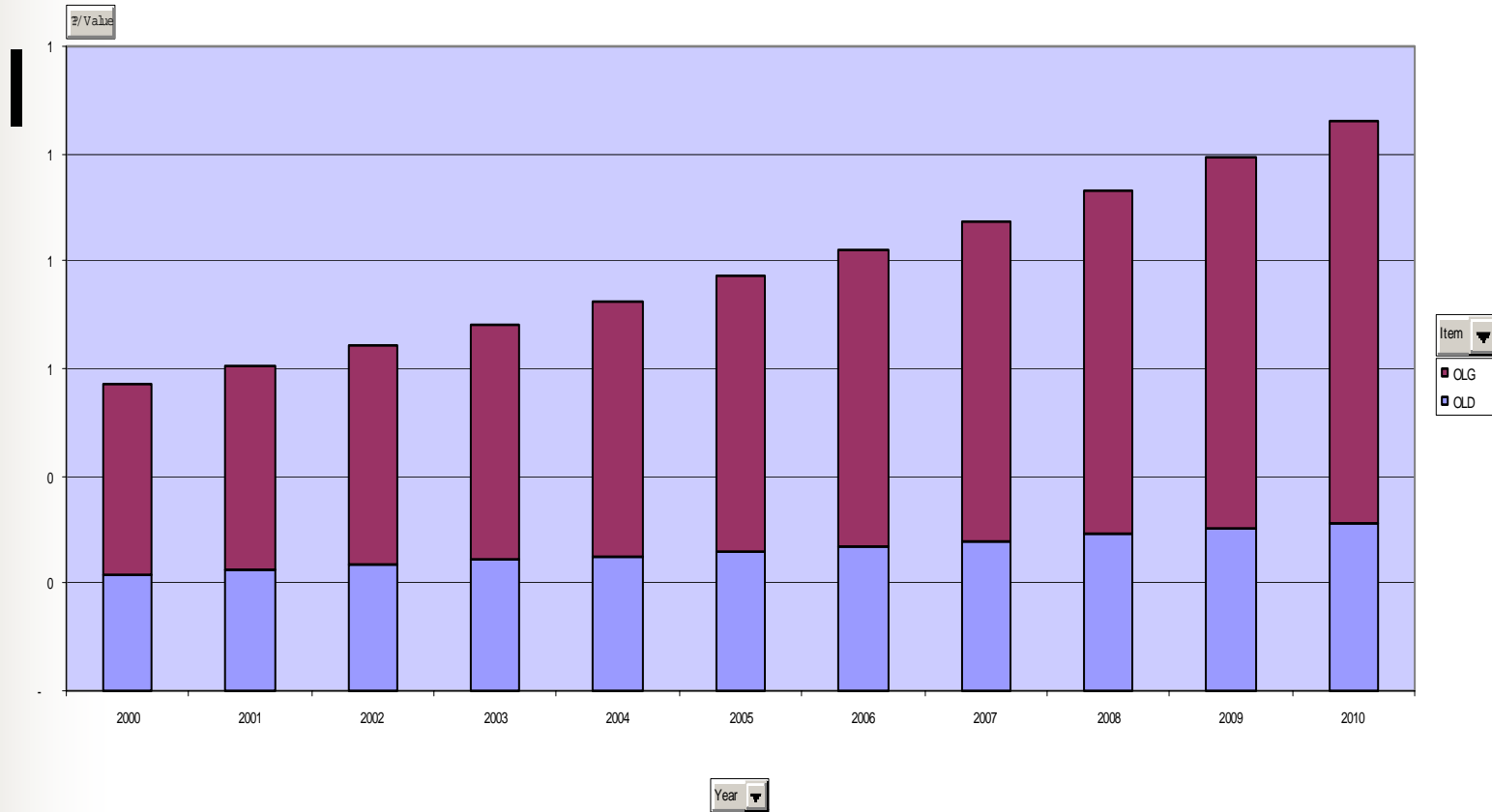
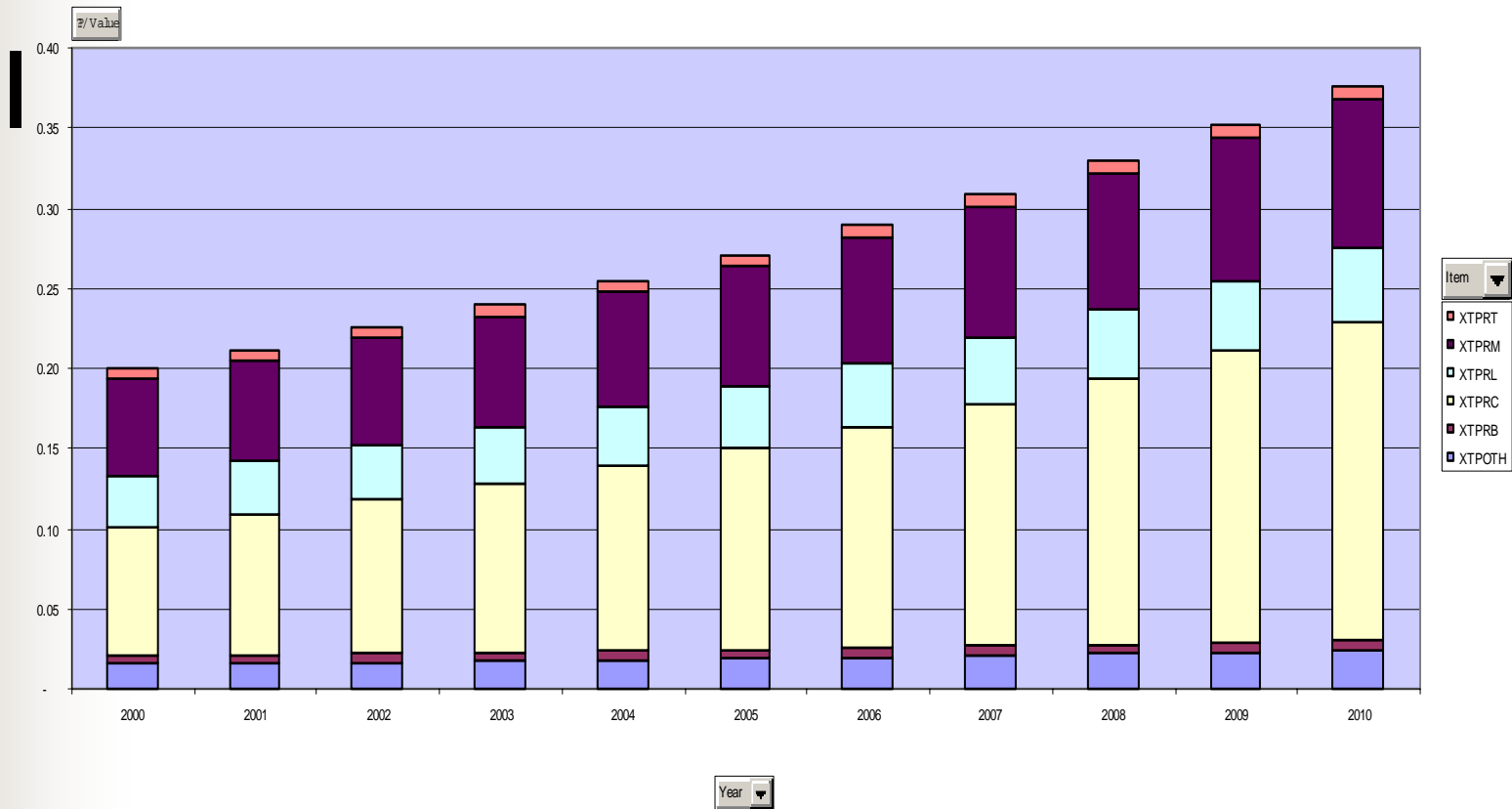


Figure 3. Proportion of Vehicle Type.

LPS_Area (All) LPS (All) Region MYS Removal NON Kind SRV Energy_Device (All) Sector (All)





WHAT NEXT?

- Further data analysis from completed sectors i.e. transport and residential.
- More information from Energy and Industrial Sectors for subsequent analysis.