Presentation on data collection methods and modelling: TRANSPORT

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Content

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2. Structure of indicators
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Structure of the indicators in transport sector: sub-sectors, segments and modes

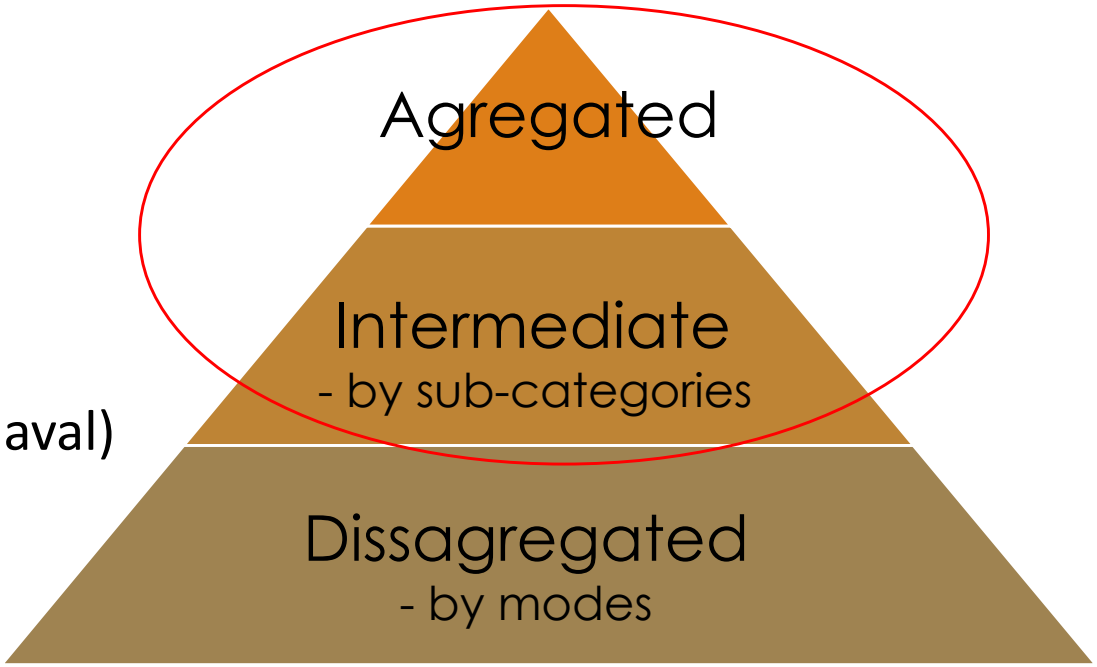
Segment Sub-sector	Passenger	Freight
Road	Personal Light Duty Vehicles - Personal cars - SUVs - Passanger light trucks Motorcycles Busses	Freight light-duty vehicles Heavy-duty vehicles Other (tractors on the roads, …)
Rail	Passenger rails - trains, metro vehicles, trams	Freight rails
Air	Passenger airplanes	Freight airplanes
Water	Passenger ships	Freight ships

Structure of the indicators in transport sector

Aggregated and intermediate indicators

Data source: Energy balance

Indicators: Total energy consumption in transport sector, Energy consumption by transport sub-categories (rail, road, air, naval) and structure of consumption



Final consumption transport in Indonesia in 2019

Data sources for aggregated and intermediate indicators **is energy balance**

Indonesia

Terajoules

	Primary coal and peat	Coal and peat products	Primary Oil	Oil Products	Natural Gas	Biofuels and waste	Nuclear	Electricity	Heat	Total energy	of which: renewables
Final consumption	973570	*20546	..	2645399	704461	1729362	..	929131	..	7002468	1729362
Final energy consumption	973570	*20320	..	2385070	445905	1729362	..	929131	..	6483358	1729362
Manufacturing, const., mining	973570	*20320	..	337531	432611	765587	..	317963	..	2847582	765587
Iron and steel	3916	*14672	..	2567	99662	..	..	8896	..	129713	..
Chemical and petrochemical	51305	..	..	6127	27095	1193	..	17338	..	103057	1193
Non-ferrous metals	..	..	..	..	..	..	..	..	..	..	..
Non-metallic minerals	..	..	..	..	..	..	..	..	..	..	..
Transport equipment	..	..	..	..	..	..	..	..	..	..	..
Machinery	..	..	..	..	..	..	..	..	..	..	..
Mining and quarrying	..	..	..	..	..	..	..	..	..	..	..
Food and tobacco	..	..	..	..	..	..	..	..	..	..	..
Paper, pulp and printing	..	..	..	..	..	..	..	..	..	..	..
Wood and wood products	..	..	..	..	..	..	..	..	..	..	..
Textile and leather	..	..	..	..	..	..	..	..	..	..	..
Construction	..	..	..	..	..	..	..	..	..	..	..
Industries n.e.s	918349	*5648	..	328838	305854	764394	..	291730	..	2614812	764394
Transport	..	..	..	920003	2564	169758	..	1001	..	1093327	169758
Road	..	..	..	748135	2564	169758	..	..	..	920457	169758
Rail	..	..	..	8945	..	..	..	1001	..	9946	..
Domestic aviation	..	..	..	121902	..	..	..	..	..	121902	..
Domestic navigation	..	..	..	41022	..	..	..	..	..	41022	..
Pipeline transport	..	..	..	..	..	..	..	..	..	..	..
Transport, n.e.s	..	..	..	..	..	..	..	..	..	..	..
Other	..	..	..	1127536	10730	794016	..	610168	..	2542449	794016
Agriculture, forestry, fishing	..	..	..	15538	..	..	..	2138	..	17676	..
Commerce, public services	..	..	..	43619	9947	43302	..	231059	..	327927	43302
Households	..	..	..	1061843	783	727774	..	376970	..	2167370	727774
Other consumers	..	..	..	*6536	..	22940	..	..	..	29476	22940
Non-energy use	0	*226	..	*260329	258556	..	..	..	..	*519110	..

Structure of the indicators in transport sector

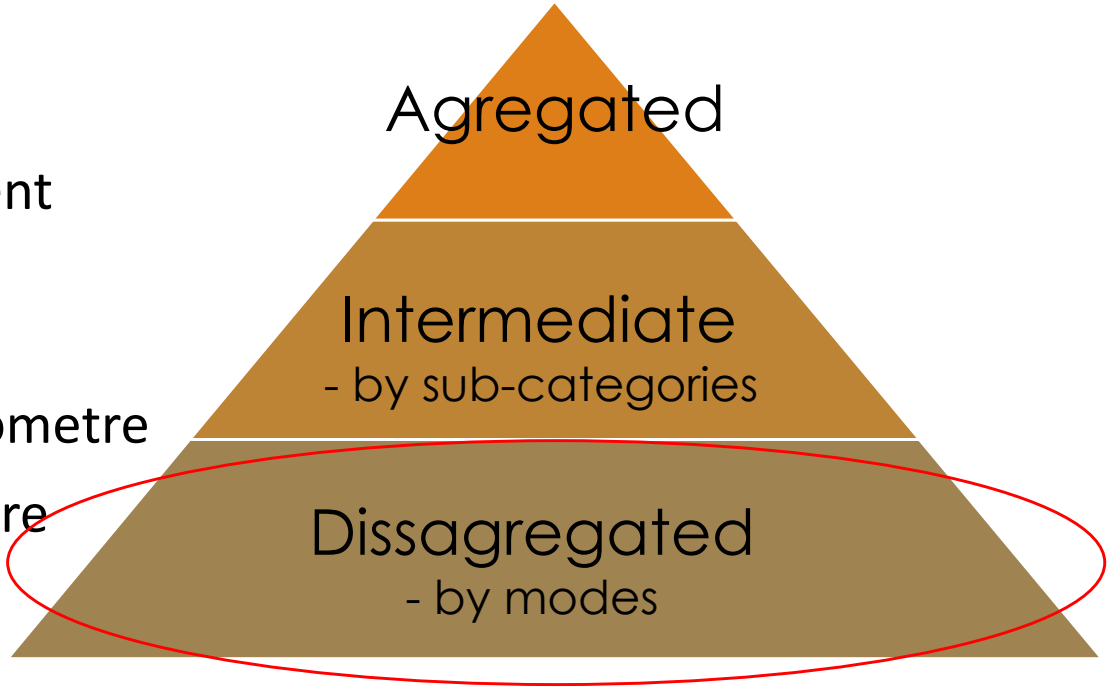
Disaggregated

Data sources: large datasets from different sources necessary

Indicators – final goal:

- Energy consumption per passenger kilometre

- Energy consumption per tonne kilometre



Sub-sectors, segments and modes in transportation sector

Dissagregated indicators

Segment / Sub-sector	Passenger, koe/pkm	Freight, koe/tkm
Road	Personal Light Duty Vehicles - Personal cars - SUVs - Passanger light trucks Motorcycles Busses	Freight light-duty vehicles Heavy-duty vehicles Other (tractors on the roads, …)
Rail	Passenger rails - trains, metro vehicles, trams	Freight rails
Air	Passenger airplanes	Freight airplanes
Water	Passenger ships	Freight ships

Modelling energy indicators in transport sector

Development of model for estimating indicators in transport sector

- Each sub-sector, segment and transport mode requires separate approach in data collection and modelling;
- Model is flexible, it allows including additional specific transport modes or excluding modes which are not relevant for a country
- Simple, easy to use, MS EXCEL based
- The quality of the model depends on the quality of input data;
- It is highly recommended to initiate modelling with existing data and estimating missing data using international benchmarks only for the purposes of developing and running the model;
- Data for modelling transport sector is time consuming activity.

Development of model for estimating indicators in transport sector (continuation)

- Proposed model includes the following segments:
  - ✓Road passenger
  - ✓Road freight
  - ✓Road total → comparison with energy balance data
  - ✓Rail passenger
  - ✓Rail freight
  - ✓Rail total → comparison with energy balance data
  - ✓Air and Water

Modelling passenger road transport (1/8 STEPS)

STEP 1: Identification of Vehicle stock number

- time series of data on total number are available in national transport statistics data base
- number of cars by type of engine rarely available in national statistics, usually available in national vehicle stock databases

			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1.	**Vehicle stocks, number**		**70,17**	**78,58**	**87,01**	**96,99**	**106,00**	**107,15**	**108,01**	**114,31**	**121,68**	**128,90**	**131,23**
	CARS, SUVS AND PERSONAL LIGHT TRUCKS		**8,89**	**9,55**	**10,43**	**10,54**	**11,56**	**12,42**	**13,28**	**13,90**	**14,80**	**15,90**	**15,97**
	gasoline	mil.	3,56	3,72	3,96	3,90	4,16	4,35	4,51	4,59	4,74	4,93	4,79
	diesel	mil.	5,33	5,82	6,45	6,61	7,35	8,01	8,68	9,22	9,95	10,83	11,02
	electric	mil.	0,00	0,01	0,02	0,03	0,05	0,06	0,08	0,10	0,12	0,14	0,16
	other	mil.											
	MOTORCYCLES												
	gasoline	mil.	**61,08**	**68,84**	**76,38**	**86,25**	**94,24**	**94,53**	**94,53**	**100,20**	**106,66**	**112,77**	**115,02**
	other	mil.											
	BUSES												
	gasoline	mil.											
	diesel	mil.	**0,20**	**0,20**	**0,20**	**0,20**	**0,20**	**0,20**	**0,20**	**0,21**	**0,22**	**0,23**	**0,23**
	electric	mil.											
	LNG	mil.											
	other	mil.											

Modelling passenger road transport (2/8 STEPS)

STEP 2: Identification of Average annual distance travelled

- data is rarely available in national official statistics
- usually available in national vehicle stock databases, various surveys' results, scientific papers

			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2.	**Average annual distance traveled**												
	CARS, SUVS AND PERSONAL LIGHT TRUCKS												
	gasoline	km	16.609	16.777	16.947	17.118	17.291	17.465	17.642	17.820	18.000	18.000	18.000
	diesel	km	19.931	20.133	20.336	20.541	20.749	20.958	21.170	21.384	21.600	21.600	21.600
	electric	km											
	other	km											
	MOTORCYCLES												
	gasoline	km	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800
	other	km											
	BUSES												
	gasoline	km											
	diesel	km	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000	50.000
	electric	km											
	LNG	km											
	other												

Modelling passenger road transport (3/8 STEPS))

STEP 3: Identification of Total annual distance travel

Total annual distance travel = Number of vehicles * Average annual distance travel

** formulas in model are coloured in blue*

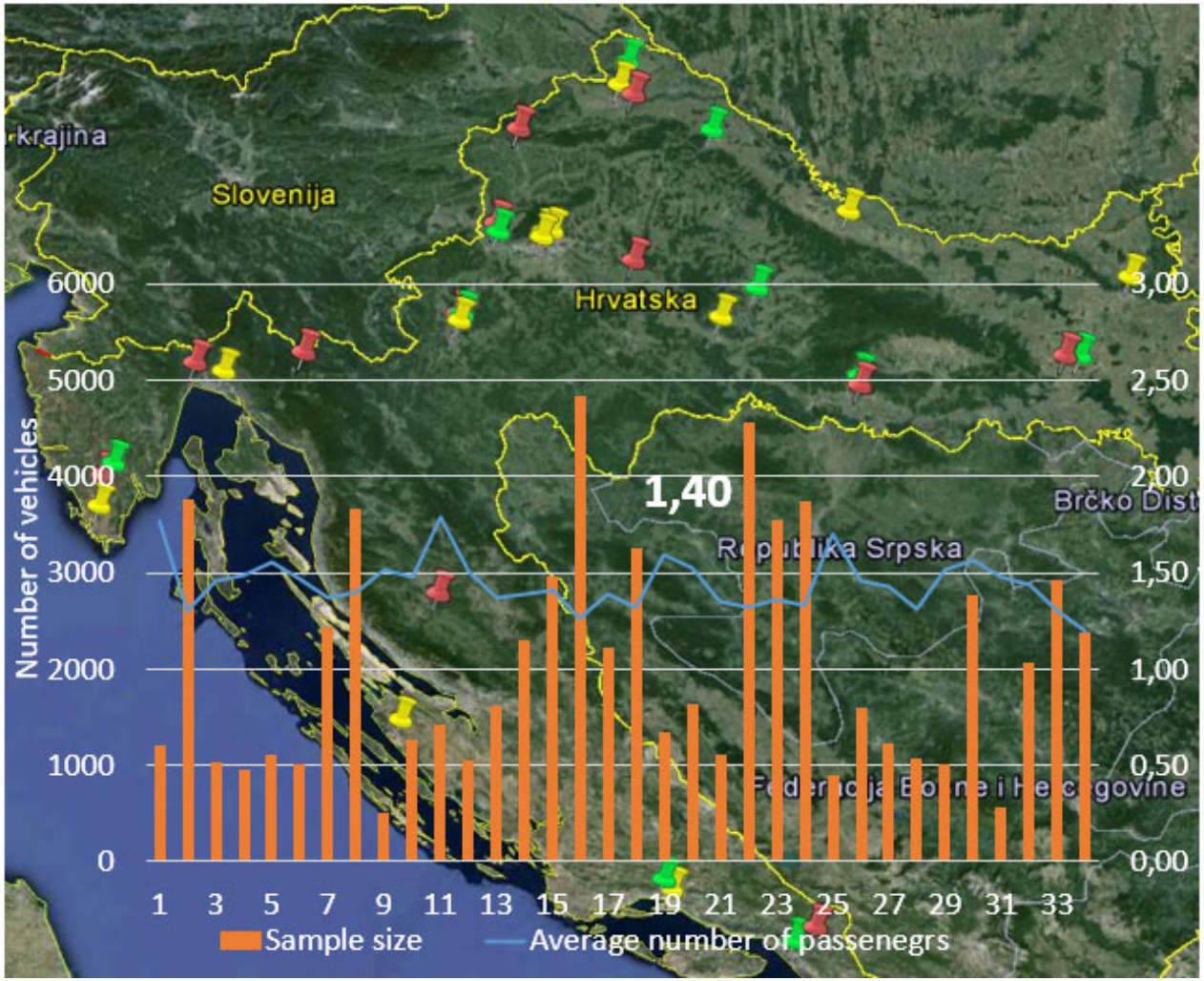
			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
3.	**Total annual distance travel, vehicle-km**												
	CARS, SUVS AND PERSONAL LIGHT TRUCKS												
	gasoline	mil.veh-km	147.675	160.203	176.792	180.422	199.898	216.990	234.248	247.698	266.400	286.200	287.460
	diesel	mil.veh-km	70.884	74.975	80.617	80.107	86.356	91.136	95.573	98.088	102.298	106.466	103.486
	electric	mil.veh-km	0	0	0	0	0	0	0	0	0	0	0
	other	mil.veh-km	0	0	0	0	0	0	0	0	0	0	0
	MOTORCYCLES												
	gasoline	mil.veh-km	232.097	261.589	290.248	327.761	358.123	359.218	359.218	380.760	405.297	428.530	437.087
	other	mil.veh-km	0	0	0	0	0	0	0	0	0	0	0
	BUSES												
	gasoline	mil.veh-km	0	0	0	0	0	0	0	0	0	0	0
	diesel	mil.veh-km	9.800	9.800	9.800	9.800	9.800	9.800	10.200	10.650	11.100	11.550	11.650
	electric	mil.veh-km	0	0	0	0	0	0	0	0	0	0	0
	LNG	mil.veh-km	0	0	0	0	0	0	0	0	0	0	0
	other	mil.veh-km	0	0	0	0	0	0	0	0	0	0	0

Modelling passenger road transport (4/8 STEPS)

STEP 4: Identification of Average occupancy per vehicle

- indicator shows an average number of passenger in transport mode during a drive
- very rarely available data in official statistics, data are usually collected in the frame of various surveys or observations

			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
4.	**AVERAGE OCCUPANCY PER VEHICLE, passangers**												
	CARS, SUVS AND PERSONAL LIGHT TRUCKS												
	gasoline	pass/vehicle	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
	diesel	pass/vehicle	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
	electric	pass/vehicle	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
	other	pass/vehicle	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
	MOTORCYCLES												
	gasoline	pass/vehicle	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
	other	pass/vehicle	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
	BUSES												
	gasoline	pass/vehicle	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00
	diesel	pass/vehicle	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00
	electric	pass/vehicle	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00
	LNG	pass/vehicle	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00
	other	pass/vehicle	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00



Survey on passenger cars' occupancy in CROATIA:

1,4 pass/car

Interurban roads

Cities

Highways

Modelling passenger road transport (5/8 STEPS)

STEP 5: Identification of Total passenger kilometres

- Total passenger kilometre = Total annual distance travelled * passenger load
- this information is very often available in national statistics, but methodology and approach for its calculation should be checked

			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
5.	**PASSANGER KILOMETRE**												
	CARS, SUVS AND PERSONAL LIGHT TRUCKS												
	gasoline	mil.pass-km	191.977	208.264	229.829	234.548	259.868	282.087	304.522	322.007	346.320	372.060	373.698
	diesel	mil.pass-km	92.149	97.468	104.802	104.139	112.263	118.476	124.245	127.515	132.987	138.406	134.531
	electric	mil.pass-km	0	0	0	0	0	0	0	0	0	0	0
	other	mil.pass-km	0	0	0	0	0	0	0	0	0	0	0
	MOTORCYCLES												
	gasoline	mil.pass-km	232.097	261.589	290.248	327.761	358.123	359.218	359.218	380.760	405.297	428.530	437.087
	other	mil.pass-km	0	0	0	0	0	0	0	0	0	0	0
	BUSES												
	gasoline	mil.pass-km	0	0	0	0	0	0	0	0	0	0	0
	diesel	mil.pass-km	98.000	98.000	98.000	98.000	98.000	98.000	102.000	106.500	111.000	115.500	116.500
	electric	mil.pass-km	0	0	0	0	0	0	0	0	0	0	0
	LNG	mil.pass-km	0	0	0	0	0	0	0	0	0	0	0
	other	mil.pass-km	0	0	0	0	0	0	0	0	0	0	0

Modelling passenger road transport (6/8 STEPS)

STEP 6: Identification of Average fuel consumption per 100 km

- this information is very often available in expert studies, scientific researches
- due to the fast changes in specific energy consumption per 100 km, many models includes separate models for „old" and „new" cars
- purple colour in model shows „assumed" values, based on international benchmarks

			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
6.	**AVERAGE FUEL CONSUMPTION**												
	CARS, SUVS AND PERSONAL LIGHT TRUCKS												
	gasoline	lit/100 km	9,95	9,85	9,75	9,66	9,56	9,46	9,37	9,28	9,18	9,09	9,00
	diesel	lit/100 km	9,69	9,59	9,49	9,40	9,30	9,21	9,12	9,03	8,94	8,85	8,76
	electric	kWh/100 km	55	55	54	54	53	52	52	51	51	50	50
	other	lit/100 km											
	MOTORCYCLES												
	gasoline	lit/100 km	4,87	4,82	4,77	4,72	4,67	4,63	4,58	4,53	4,49	4,44	4,40
	other	lit/100 km											
	BUSES												
	gasoline	lit/100 km	28,75	28,46	28,18	27,90	27,62	27,34	27,07	26,80	26,53	26,26	26
	diesel	lit/100 km	48,65	48,17	47,68	47,21	46,73	46,27	45,80	45,35	44,89	44,44	44
	electric	kWh/100 km	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0
	LNG	lit/100 km	16,59	16,42	16,26	16,09	15,93	15,77	15,62	15,46	15,30	15,15	15
	other	lit/100 km	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0

Modelling passenger road transport (7/8 STEPS)

STEP 7: Identification of Fuel consumption of transport modes

- Total fuel consumption = Average fuel consumption /100 km /100 * Distance travelled
- Specific consumption per vehicles: Total fuel consumption / number of vehicles

			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
7.	**TOTAL FUEL CONSUMPTION**												
	CARS, SUVS AND PERSONAL LIGHT TRUCKS												
	gasoline	TJ	187.781	201.675	220.332	222.608	244.172	262.399	280.435	293.572	312.580	332.455	330.579
	diesel	TJ	86.301	90.369	96.198	94.634	100.995	105.520	109.551	111.310	114.925	118.413	113.946
	electric	TJ	0	0	0	0	0	0	0	0	0	0	0
	other	TJ	0	0	0	0	0	0	0	0	0	0	0
	Total	TJ	274.082	292.044	316.530	317.242	345.167	367.918	389.986	404.882	427.506	450.867	444.525
	Total per car	MJ/car	30.827	30.584	30.341	30.099	29.856	29.613	29.371	29.128	28.886	28.356	27.835
	MOTORCYCLES												
	gasoline	TJ	135.661	151.370	166.274	185.886	201.075	199.672	197.676	207.435	218.594	228.814	231.049
	other	TJ	0	0	0	0	0	0	0	0	0	0	0
	Total	TJ	135.661	151.370	166.274	185.886	201.075	199.672	197.676	207.435	218.594	228.814	231.049
	Total per motor vehicle	MJ/motorcyc	2.221	2.199	2.177	2.155	2.134	2.112	2.091	2.070	2.050	2.029	2.009
	BUSES												
	gasoline	TJ	0	0	0	0	0	0	0	0	0	0	0
	diesel	TJ	59.930	59.331	58.737	58.150	57.568	56.993	58.726	60.703	62.636	64.523	64.431
	electric	TJ	0	0	0	0	0	0	0	0	0	0	0
	LNG	TJ	0	0	0	0	0	0	0	0	0	0	0
	other	TJ	0	0	0	0	0	0	0	0	0	0	0
	Total	TJ	59.930	59.331	58.737	58.150	57.568	56.993	58.726	60.703	62.636	64.523	64.431
	Total per bus	MJ/bus	305.764	302.707	299.680	296.683	293.716	290.779	287.871	284.992	282.142	279.321	276.528

Modelling passenger road transport (8/8 STEPS)

STEP 8: CALCULATION OF INDICATORS

- Transport indicators = Total fuel consumption / Total passenger-kilometre
- Decreasing energy efficiency indicators leads to the conclusions that there are improvements in efficiency in energy use; lower fuel consumption /100 km, more passengers per transport modes, etc.
- - International benchmarks available in ODYSSEE database (EU countries)

			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
8.	ENERGY EFFICIENCY INDICATORS AND COMPARISON WITH EU RANGES												
	CARS, SUVS AND PERSONAL LIGHT TRUCI	MJ/pass-km	0,965	0,955	0,946	0,937	0,928	0,919	0,910	0,901	0,892	0,883	0,875
	MOTORCYCLES	MJ/pass-km	0,584	0,579	0,573	0,567	0,561	0,556	0,550	0,545	0,539	0,534	0,529
	BUSES	MJ/pass-km	0,612	0,605	0,599	0,593	0,587	0,582	0,576	0,570	0,564	0,559	0,553
	TOTAL												
	CARS, SUVS AND PERSONAL LIGHT TRUCI	koe/pkm	0,023	0,022	0,022	0,022	0,022	0,022	0,021	0,021	0,021	0,021	0,021
	MOTORCYCLES	koe/pkm	0,014	0,014	0,013	0,013	0,013	0,013	0,013	0,013	0,013	0,013	0,012
	BUSES	koe/pkm	0,014	0,014	0,014	0,014	0,014	0,014	0,013	0,013	0,013	0,013	0,013

Modelling freight road transport (1/8 STEPS) ……..

STEP 1: Identification of Vehicle stock number

- the basic disaggregation per transport mode is considered
- additional disaggregation can include: light freight vehicles, heavy freight vehicles, new vehicles….

			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1.	**Vehicle stocks, number**												
	FREIGHT COMMERCIAL TRANSPORT	mil.	**3,10**	**3,30**	**3,50**	**3,70**	**3,90**	**4,10**	**4,30**	**4,50**	**4,70**	**5,00**	**5,00**
	gasoline	mil.	1,55	1,62	1,68	1,74	1,79	1,85	1,89	1,94	1,97	2,05	2,00
	diesel	mil.	1,55	1,68	1,81	1,95	2,09	2,23	2,38	2,53	2,69	2,91	2,95
	electric	mil.	0,00	0,00	0,01	0,01	0,02	0,02	0,03	0,03	0,04	0,05	0,05
	other												

- REPEAT ALL OTHER STEPS AS PER PASSENGER ROAD TRANSPORT!

Completion of modelling ROAD transport (1/2)

The final stage in modelling road transport is aggregation of consumption of road passenger and road fright transport and comparison with national energy balance data.

Total by type of FUEL			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	0
2.1	TOTAL ROAD TRANSPORT - MODEL												
	gasoline	TJ	858192	922295	990357	1046744	1117997	1169321	1219861	1277257	1341925	1423768	1424128
	diesel	TJ	485229	503351	522365	533117	550926	566029	582073	595214	609291	631288	615794
	electric	TJ	0	0	0	0	0	0	0	0	0	0	0
	LNG	TJ	0	0	0	0	0	0	0	0	0	0	
	other	TJ	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	TJ	1.343.421	1.425.646	1.512.722	1.579.862	1.668.923	1.735.350	1.801.934	**1.872.471**	**1.951.216**	**2.055.056**	**2.039.922**

2.2.	IEA/ENERGY BALANCE DATA										
	Total Energy Use in Road Transport	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
	From the APEC energy balances:										
	Motor Gasoline (including biofuels)	791,63	877,41	971,05	1.012,17	1.012,17	1.048,32	1.092,58	1.133,22	1.167,18	1.206,82
	Automotive Diesel (including biofuels)	424,34	608,65	796,72	802,61	807,42	789,07	621,45	712,96	831,52	833,07
	LPG (Liquefied Petroleum Gas)	0	0	0	0	0	0	0	0	0	0
	Natural Gas	1,11	1,03	0,87	1,05	1,18	1,40	1,16	0,52	1,33	1,13
	Electricity	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0
	Total	**1.217,08**	**1.487,09**	**1.768,64**	**1.815,83**	**1.820,76**	**1.838,79**	**1.715,20**	**1.846,71**	**2.000,02**	**2.041,02**

MUST BE EQUAL!!!!

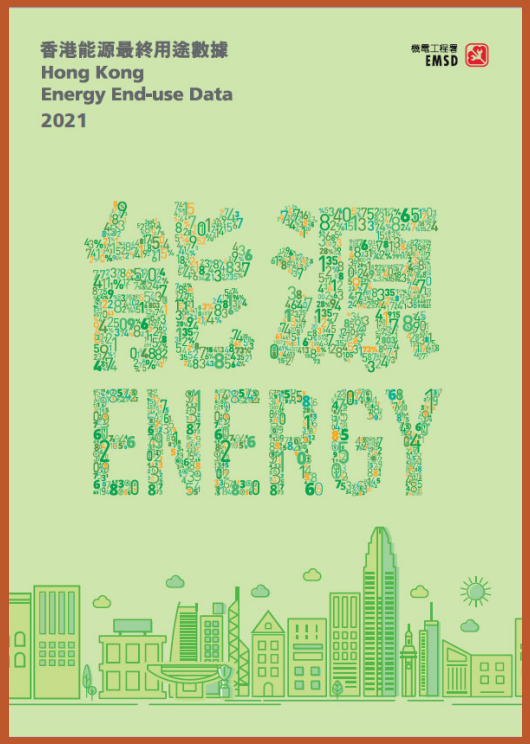
Completion of modelling ROAD transport (2/2)

- MAKE DECISION HOW TO IMPROVE DATA !!!!

Difference between modelled data and IEA data												
TOTAL ROAD TRANSPORT		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gasoline	%	7,76	4,87	1,95	3,30	9,47	10,35	10,43	11,28	13,02	15,24	100
Diesel	%	12,55	-20,92	-52,52	-50,55	-46,56	-39,41	-6,77	-19,78	-36,47	-31,96	100
LPG	%	-	-	-	-	-	-	-	-	-	-	-
Natural Gas	%	-	-	-	-	-	-	-	-	-	-	-
Electricity	%	-	-	-	-	-	-	-	-	-	-	-
Other		-	-	-	-	-	-	-	-	-	-	-
TOTAL		**9,40**	**-4,31**	**-16,92**	**-14,94**	**-9,10**	**-5,96**	**4,81**	**1,38**	**-2,50**	**0,68**	**100**

Examples of good practices

Example: HONG KONG



4.4 運輸類別 Transport Sector

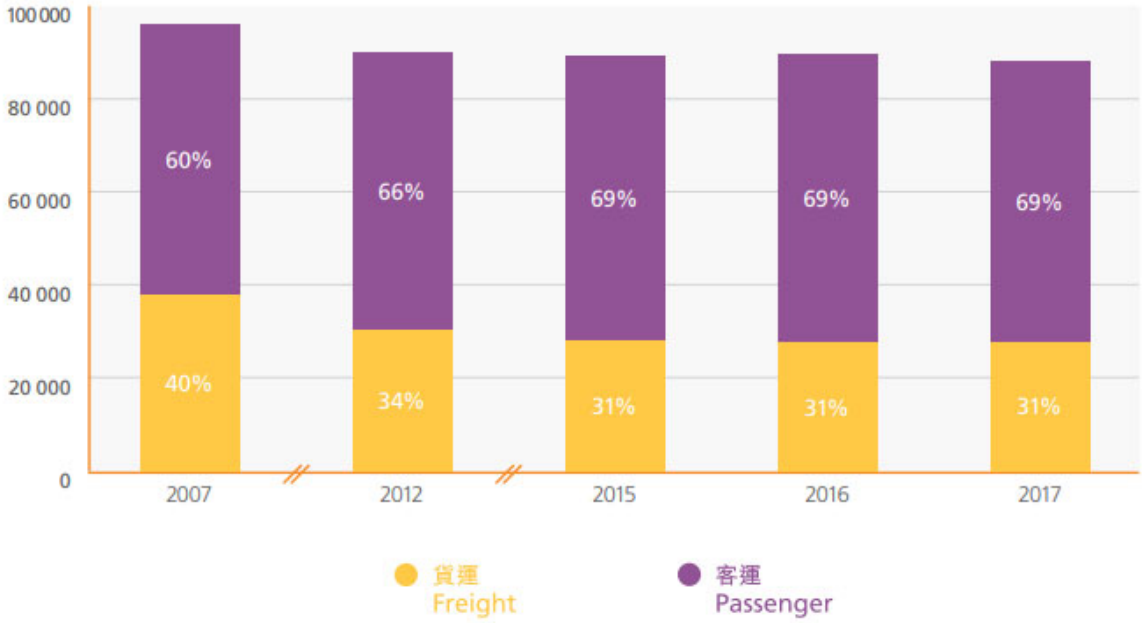
圖表 Chart 45

運輸類別所有能源使用按組別劃分

Total Energy Consumption in Transport Sector by Segment

參考表格 Refer Table 55

單位 Unit：太焦耳 Terajoule



表格 Table 57

客運組別所有能源使用按最終用途劃分

Total Energy Consumption in Passenger Segment by End-use

單位 Unit：太焦耳 Terajoule

	巴士 Bus	的士 Taxi	汽車 Car	電單車 Motorcycle	鐵路 Rail	船隻 Marine	其他 Others	總計 Total
2007	19,832	14,102	17,118	463	2,495	3,758	215	57,983
2008	18,971	15,142	17,059	480	2,520	3,758	207	58,137
2009	19,150	13,131	17,449	465	2,523	3,810	190	56,718
2010	18,842	13,373	18,247	436	2,540	3,930	193	57,560
2011	18,911	13,593	18,795	425	2,609	4,110	103	58,546
2012	19,128	13,469	19,432	421	2,722	4,251	102	59,526
2013	19,144	13,319	20,955	411	2,796	4,434	102	61,161
2014	19,285	13,696	20,815	424	2,875	4,441	106	61,641
2015	19,168	12,437	21,764	448	2,972	4,523	108	61,421
2016	18,918	12,288	22,880	462	2,951	4,512	124	62,136
2017	**18,663**	**10,686**	**22,996**	**489**	**3,129**	**4,511**	**147**	**60,622**

Example – Hong Kong Passenger transportation

表格 Table 56

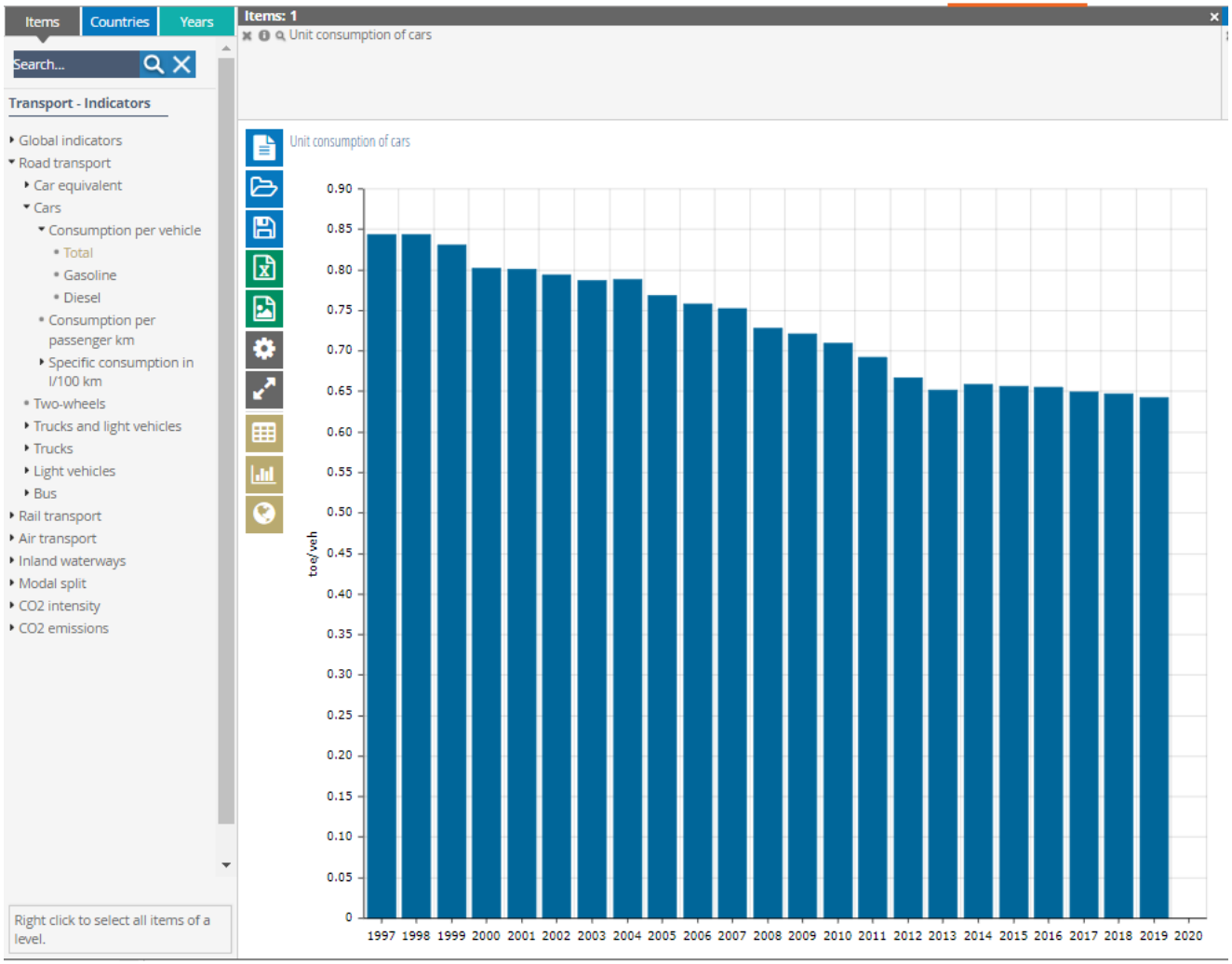
貨運組別所有能源使用按最終用途劃分

Total Energy Consumption in Freight Segment by End-use

單位 Unit：太焦耳 Terajoule

	貨車 Goods Vehicle	船隻 Marine	其他 Others	總計 Total
2007	31,771	6,400	11	38,182
2008	30,438	5,922	7	36,367
2009	28,501	5,418	6	33,925
2010	28,585	4,741	2	33,329
2011	27,818	4,134	-	31,952
2012	26,681	3,826	-	30,507
2013	25,126	3,305	-	28,431
2014	24,510	3,264	-	27,774
2015	24,782	3,269	-	28,051
2016	24,718	2,961	-	27,680
2017	**24,845**	**2,947**	-	**27,793**

Example – Hong Kong Freight transportation

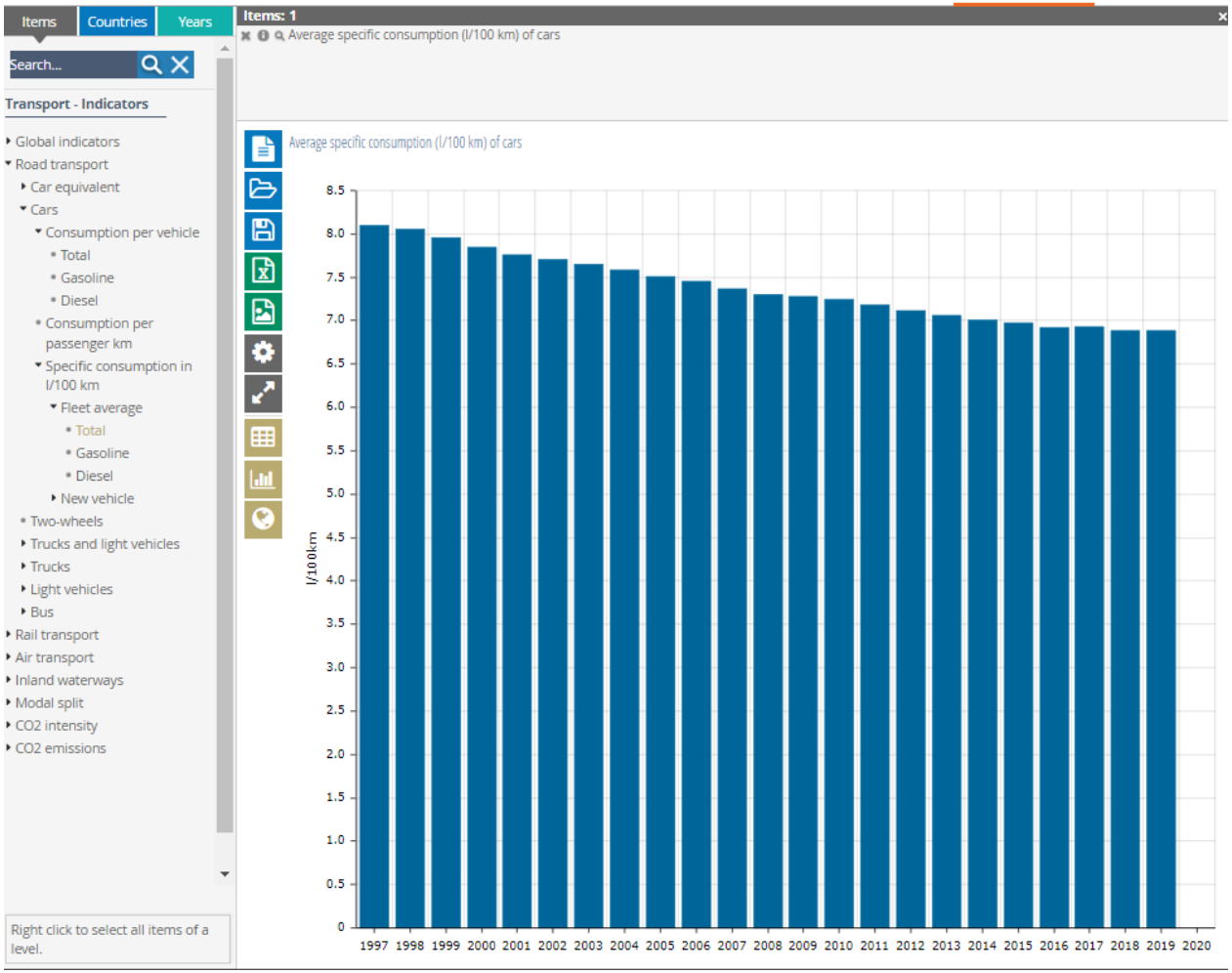


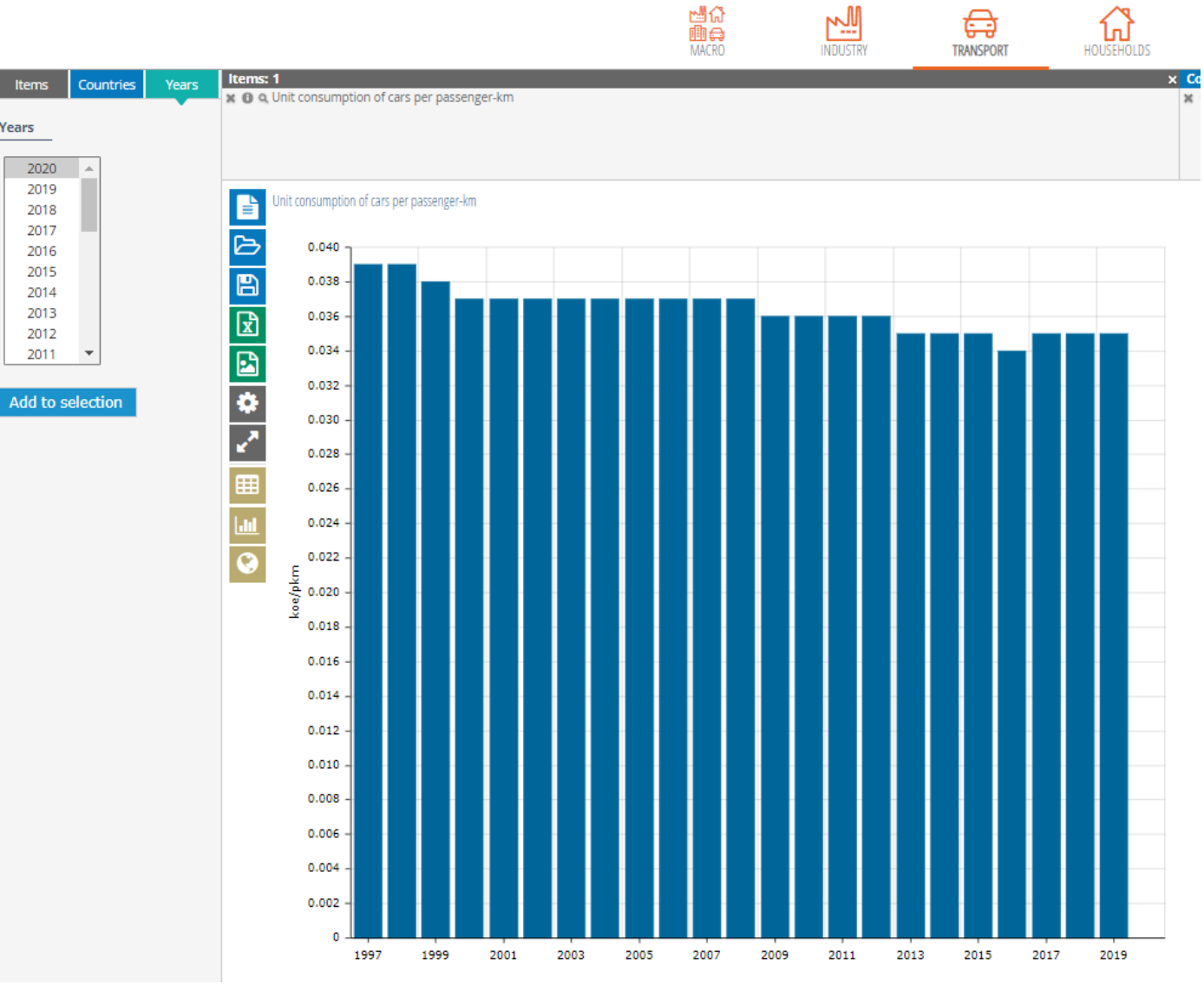
EUROPEAN UNION: Average fuel consumption in personal cars, toe/vehicle

SOURCE: ODYSSEE DATABASE

EUROPEAN UNION: Average fuel consumption in personal cars in EU, lit/100 km

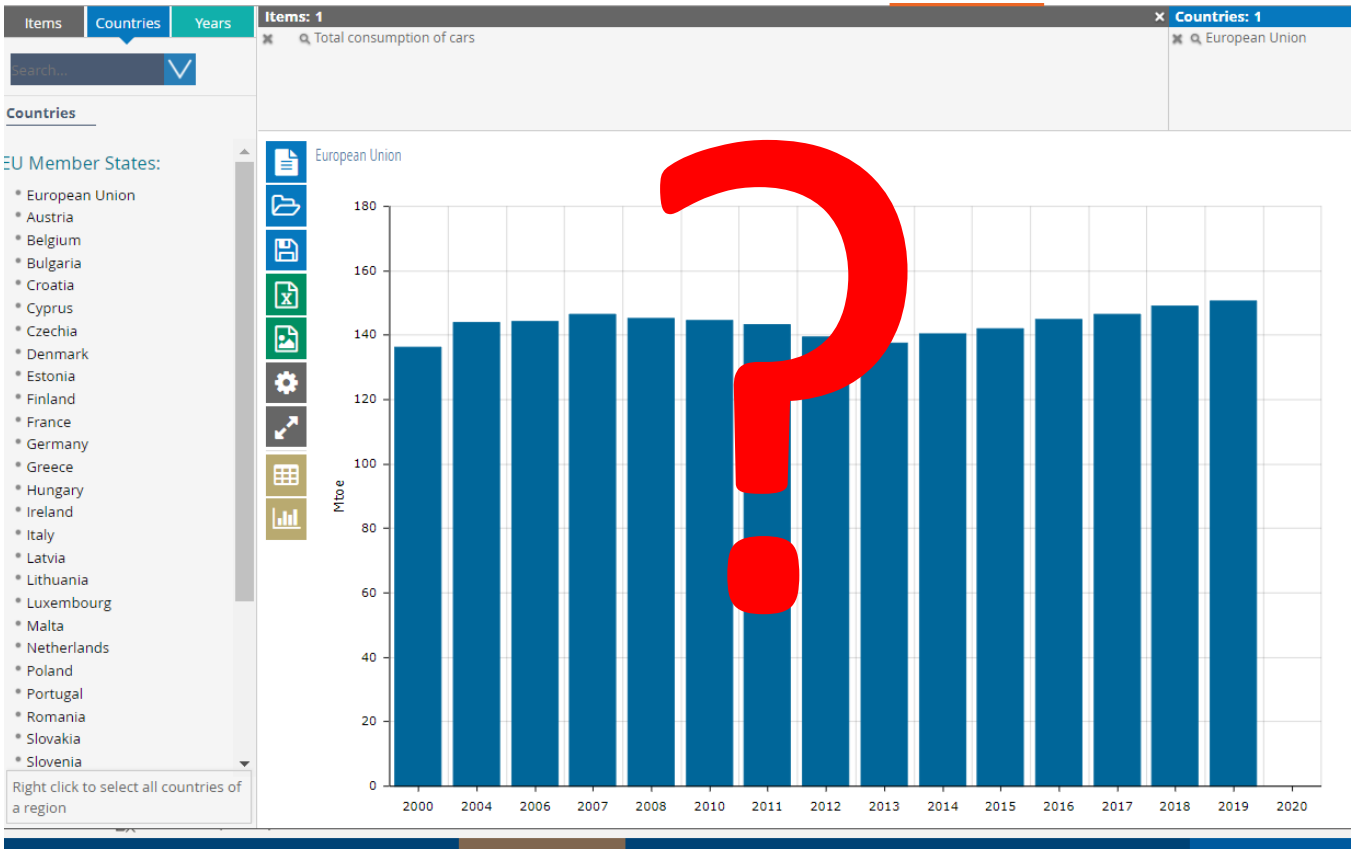
SOURCE: ODYSSEE DATABASE





EUROPEAN UNION: Energy intensity of personal cars in EU, koe/pkm

SOURCE: ODYSSEE DATABASE



EUROPEAN UNION, Total fuel consumption in personal cars, Mtoe

Reports | Table | Chart

EEI TRANSPORT

Other: PRODUCT/FLOW - Fuel intensity (litres/100 vkm) | ENDU

COUNTRY / TIME	Australia	Austria	Finland	France	Italy	Japan	Korea
2010	11.09	7.50	6.70	7.13	5.56	8.19	7.76
2011	11.03	7.43	6.60	6.97	5.52	8.24	7.82
2012	10.98	7.37	6.69	6.84	5.25	8.03	7.90
2013	10.76	7.34	6.66	6.66	5.18	7.63	8.30
2014	10.62	7.30	6.59	6.61	5.16	7.39	7.90
2015	10.60	7.26	6.66	6.58	5.04	7.33	7.99
2016	10.71	7.25	6.66	6.45	4.90	7.18	8.33
2017	10.32	7.22	6.59	6.46	4.71	7.01	8.19
2018	10.27	7.38	6.53	6.37	4.77	6.80	8.14
2019	10.24	7.35	6.44	6.35	4.75	6.63	8.29
2020	10.18	..	6.22	6.30	4.53	6.65	7.92

Reports | Table | Chart

EEI TRANSPORT

Other: PRODUCT/FLOW - Passenger-kilometres energy intensity (MJ/pkm)

COUNTRY / TIME	Australia	Austria	Finland	France	Italy	Japan	Korea
2010	2.33	2.14	1.41	1.48	1.20	2.22	..
2011	2.32	2.12	1.36	1.45	1.23	2.21	2.28
2012	2.31	2.11	1.36	1.43	1.33	2.16	2.31
2013	2.26	2.11	1.37	1.39	1.20	2.06	2.38
2014	2.24	2.10	1.37	1.39	1.24	2.01	2.32
2015	2.23	2.10	1.35	1.38	1.12	1.99	2.32
2016	2.26	2.10	1.35	1.36	1.04	1.95	2.51
2017	2.18	2.09	1.33	1.36	0.89	1.90	2.48
2018	2.16	2.14	1.32	1.34	0.99	1.84	2.48
2019	2.15	2.14	1.30	1.34	1.01	1.79	2.50
2020	2.14	..	1.26	1.34	1.16	1.82	2.49

Exercise

ANALYSIS AND MODELLING OF TRANSPORTATION INDICATORS IN ONE FAMILY – „SCHMIDT” FAMILY

Exercise: Calculation of energy efficiency indicators for "Schmidt" family

In period 2010-2013, Mr and Ms Schmidt travel together by every day to work by their personal car, the yaer of the car production is 2005. Every morning Mr Schmidt drives first Ms Schmidt to her office and then he goes to his company. The Car 1 is gasoline car, and fuel consumption of this car is about 9,3 lit. Average annual distance travel is about 16.800 km/year. This includes travel to work and other private travels and thus average number of passangers in car is about 2,2 passangers.

EXE 1 AKL S1 SCENARIO
In 2014, their daugher starts to attend new school and she needs transporation as well. With aim to save the time, Mr.and Ms Schmidt **decied to buy second Car2 (SUV)** for the use of Ms Smith to travel to work, while Mr. Schmidt drives every morning their daughter to school and to pick her on his back home. Car 2 is diesel car, and due to the use of this car only for the purpose of traveling to and back from work (20 km/day in 220 working days), average distance travel is thus about 5000 km/year, and average occupancy is 1 person.

EXE 2 AKL S2 SCENARIO
In 2014, their daugher starts to attend new school, far from their home, and she needs transporation as well. With aim to save the time, Mr.and Ms Schmidt **decied to buy a Motorcycle** for the use of Ms Smith to travel to work, while Mr. Schmidt drives every morning their daughter to school and to pick her on his back home. Motorcycle uses gasoline, and due to the use of this car only for the purpose of traveling to and back from work (20 km/day in 220 working days), average distance travel is thus about 5000 km/year, and average occupancy is 1 person, average fuel consumption ammounts 4,1 lit/ 100 km.

EXE 3 AKL S4 SCENARIO
In 2014, their daugher starts to attend new school, far from their home, and she needs transporation as well. With aim to save the time, Mr.and Ms Schmidt **decied to buy a small efficent car** for the use of Ms Smith to travel to work, while Mr. Schmidt drives every morning their daughter to school and to pick her on his back home. Motorcycle uses gasoline, and due to the use of this car only for the purpose of traveling to and back from work (20 km/day in 220 working days), average distance travel is thus about 5000 km/year, and average occupancy is 1 person, average fuel consumption ammounts 4,1 lit/ 100 km.

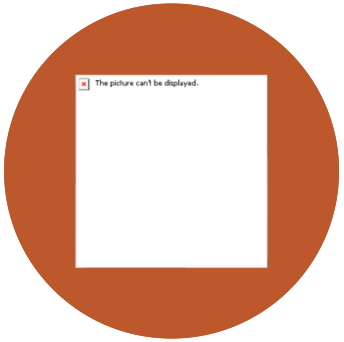
Can you please calculate and analyse energy tranportation inidcators of SCHMIDT family?

....and recommendations

Conclusions

- Transport sector is the most complex sector for modelling energy efficiency;
- Each transport mode requires specific modelling techniques and data sets;
- Development of the transport model can be based on the certain assumptions which are used for the purpose of the completion of modelling processes and analysis of sensitivities of specific indicators in the model
- Assumptions can give information how to improve data collection and to what new datasets should be given priority.

Content



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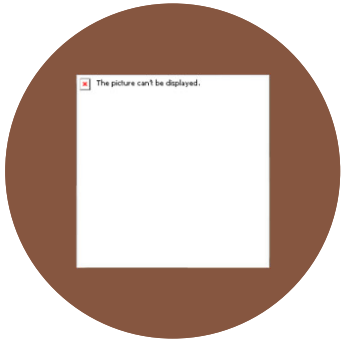

NUNC VIVERRA IMPERDIET ENIM. FUSCE EST. VIVAMUS A TELLUS.

PELLENTESQUE HABITANT MORBI TRISTIQUE SENECTUS ET NETUS.