GFEI GLOBAL NETWORKING MEETING 2016

Setting of the FE baseline

9-10 JUNE 2016 - PARIS

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GFEI target – Maximising the benefits of improved fuel economy

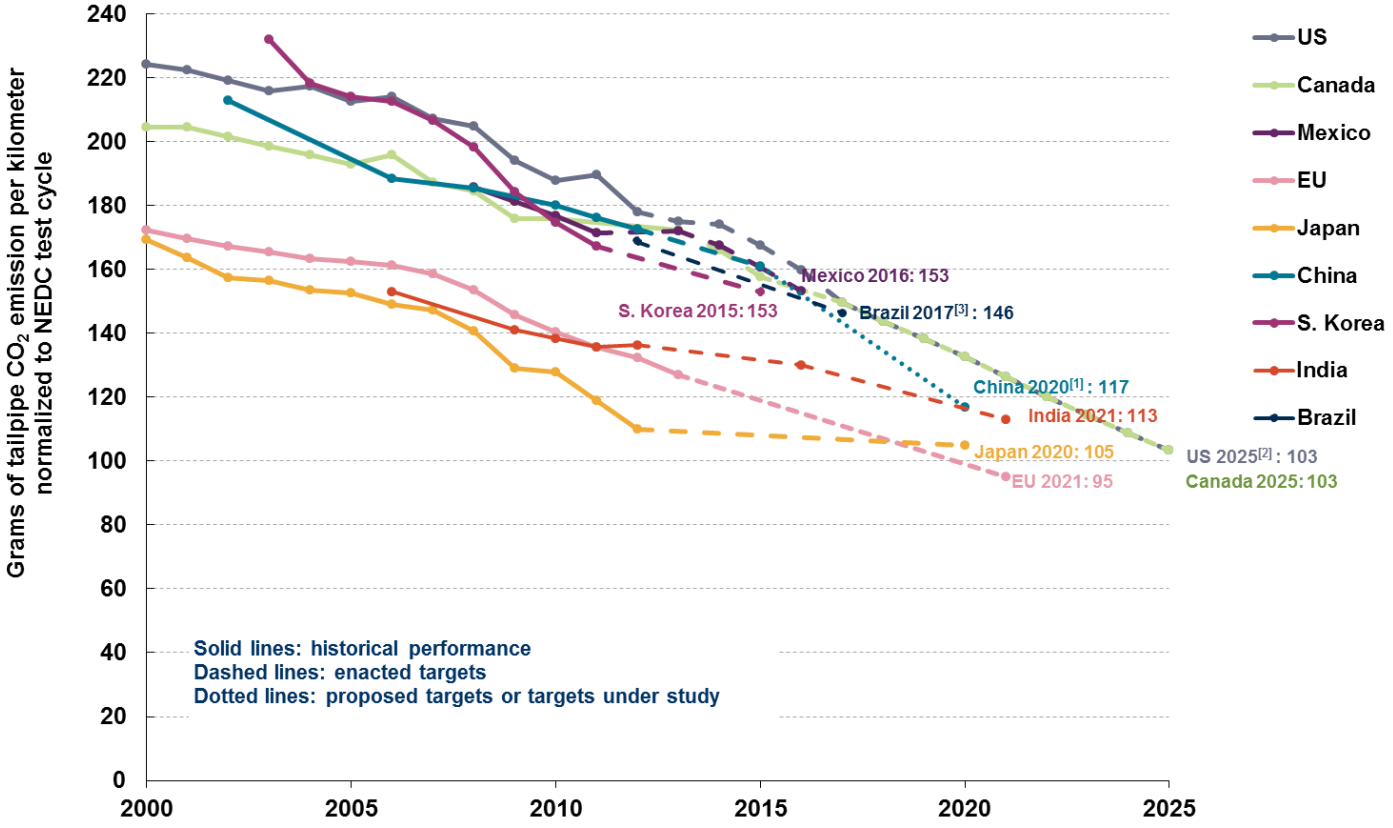
- Reduce new passenger light-duty vehicle fuel consumption (Lge/100km) by 50% until 2030 globally

- Reduce passenger light-duty vehicle stock fuel consumption (Lge/100km) by 50% until 2050 globally

Technical steps to introduce FE policies

- FE Baseline – What is the average fuel economy of new passenger vehicles registered for the first time?
- Target – Where will fuel economy need to be in the future?
- Identification of policies – Which measures are appropriate to reach the target?
- Impact assessment of policy measures – Regulatory, monetary and soft measures

To set fuel economy targets, the past needs to be understood



[1] China's target reflects gasoline vehicles only. The target may be higher after new energy vehicles are considered.
[2] US fuel economy stadards set by NHTSA reflecting tailpipe GHG emission (i.e. exclude low-GWP refrigerant credits).
[3] Gasoline in Brazil contains 22% of ethanol (E22), all data in the chart have been converted to gasoline (E00) equivalent
[4] Supporting data can be found at: http://www.theicct.org/info-tools/global-passenger-vehicle-standards.

Source: ICCT

What is a fuel economy baseline

- The fuel economy baseline is the weighted average fuel economy of all vehicles registered for the first time in a given year in a country
- The weighted average fuel economy is calculated using model specific fuel economy values and the number of registered vehicles as weight

Fuel economy baseline: firstly registered vs. running vehicle fleet

Firstly registered cars vs. running vehicle fleet

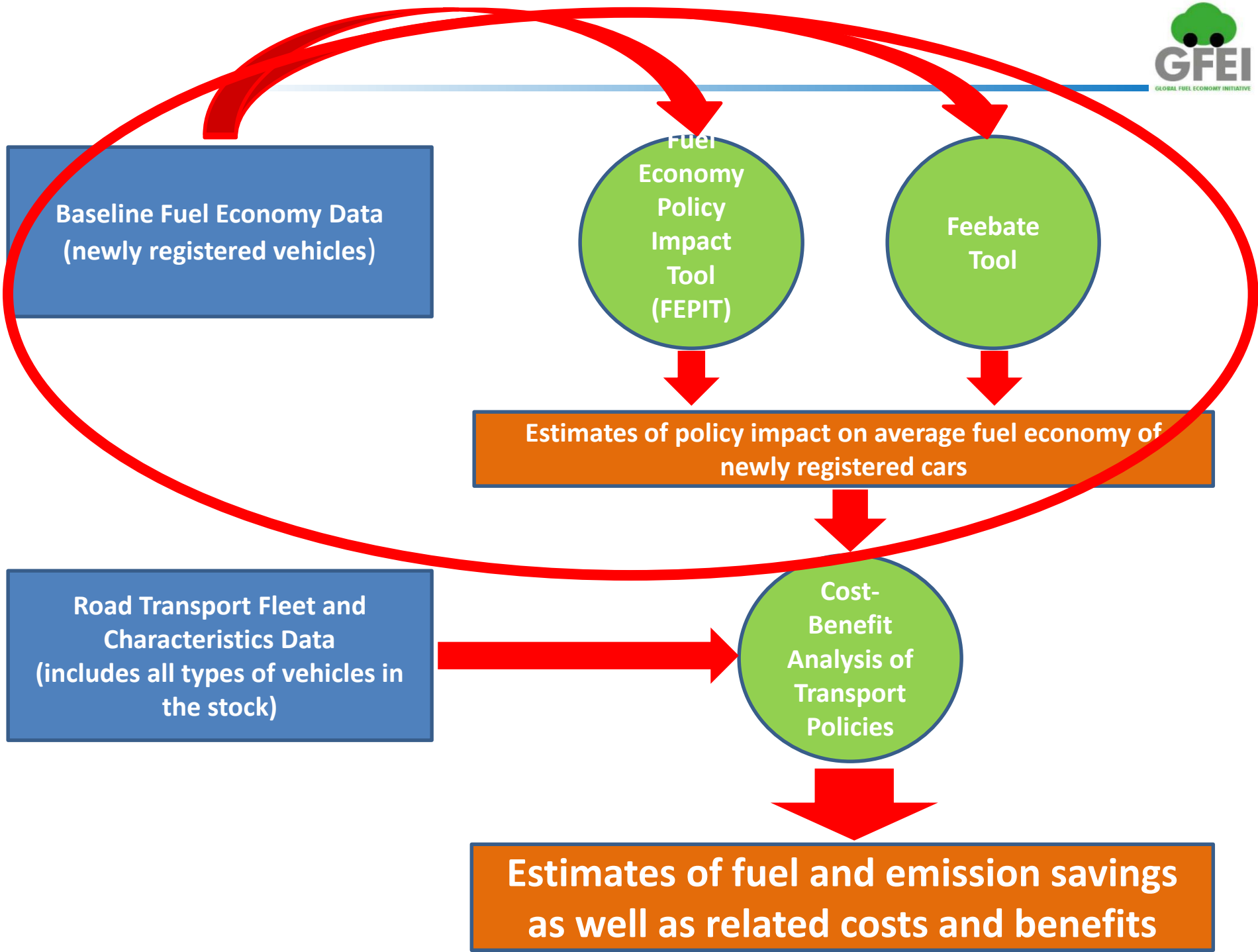
Firstly registered vehicles:

+ **FE policy instruments such as standards, feebates, registration taxes or import taxes only *target vehicles which are registered for the first time***
+ **First registrations are relatively easy to control**
+ **Policies only affecting firstly registered vehicles are easier to communicate**
– **Delayed impact on fuel use and emissions since new cars need to penetrate into stock**

Firstly registered cars vs. running vehicle fleet

Running vehicle fleet

+ **Ambitious policies show immediate results**
– **Baseline setting for vehicle stock in use more complex**
  - Much more older cars – difficult to find missing data
– **Vehicle stock only targeted by fuel tax and vehicle circulation tax**
– **Affects all vehicle owners immediately – can be more complex to find socially balanced solutions**


Baseline Fuel Economy Data (newly registered vehicles)
Fuel Economy Policy Impact Tool (FEPIT)
Feebate Tool
Estimates of policy impact on average fuel economy of newly registered cars
Road Transport Fleet and Characteristics Data (includes all types of vehicles in the stock)
Cost-Benefit Analysis of Transport Policies
Estimates of fuel and emission savings as well as related costs and benefits

Fuel economy baseline development

Vehicle coverage – passenger cars, heavy duty vehicles, 2/3 wheelers?

- **Passenger car FE data is relatively easy to get – FE standards are widely spread, UN regulation for FE/emission measurement are in place, testing procedures have a long history**
- **HDVs – large variety of HDV models and mission profiles greatly affect HDV FE**
  - Different approaches: US – engine testing and limited simulation; China – extensive lab testing; EU – extensive simulation with complex modelling
- **2/3 wheelers – restricted data: China is the only country having mandatory FE standards for two wheelers in place (implemented 2009)**

Development of fuel economy baseline

Possible barriers

- Availability: What data is available – national car registration? What institutional framework is needed to continuously collect and develop data?
- Accessibility: Who is in charge of the data? Can the data be shared?
- Vehicle market structure: Is the share of used imported vehicles significant?
- Data gaps: How to get FE data? How to convert FE data based on different test cycles?

Fuel economy baseline methodology

FE baseline setting: How to get from the vehicle registration database to average new vehicle FE?

Country	Year	Vehicle Type	Model	Engine ccm	Engine kW	Fuel type	Transmission type	Emission standard	Vehicles registered	Final FE data, lge/100km
xxx	2013	Pass.	VW Polo	1199	55	Diesel	Manual	EURO5	614	4.1
xxx	2013	Pass.	VW Polo	1199	55	Diesel	Manual	EURO5	512	3.7
xxx	2013	Pass.	Renault Clio	1461	55	Diesel	Manual	EURO5	1474	3.9
xxx	2013	Pass.	Renault Clio	1461	55	Diesel	Manual	EURO5	1448	4.1
xxx	2013	Pass.	Renault Clio	1461	55	Diesel	Manual	EURO5	1140	4.3
xxx	2013	Pass.	Suzuki Grand Vitara	1870	95	Diesel	Manual	EURO5	217	7.5
xxx	2013	Pass.	Jaguar XF	2179	147	Diesel	Automatic	EURO5	20	5.8
xxx	2013	Pass.	Audi A7	2967	180	Diesel	Automatic	EURO5	37	6.5
xxx	2013	Pass.	Audi A7	2967	180	Diesel	Automatic	EURO6	29	6.4
xxx	2013	Pass.	BMW 535	2993	230	Diesel	Automatic	EURO6	2	6.0
xxx	2013	Pass.	BMW 535	2993	230	Diesel	Automatic	EURO5	1	6.2
xxx	2013	Pass.	Jeep Grand Cherokee	2987	184	Diesel	Automatic	EURO5	97	8.1
xxx	2013	Pass.	BMW X6	2993	180	Diesel	Automatic	EURO5	61	8.0
xxx	2013	Pass.	Citroen C5	1560	84	Diesel	Manual	EURO5	286	5.2
xxx	2013	Pass.	Citroen C5	1560	84	Diesel	Automatic	EURO5	247	4.8

Sales weighted average FE

SUM | =SUMPRODUCT(J2:J16,K2:K16)/SUM(J2:J16)

SUMPRODUCT(**array1**, [array2], [array3], [array4], ...)

	A	B	C	D	E	F	G	H	I	J	K
1	Country	Year	Vehicle Type	Model	Engine ccm	Engine kW	Fuel type	Transmission type	Emission standard	Vehicles registered	Final FE data, lge/100km
2	xxx	2013	Pass.	VW Polo	1199	55	Diesel	Manual	EURO5	614	4.1
3	xxx	2013	Pass.	VW Polo	1199	55	Diesel	Manual	EURO5	512	3.7
4	xxx	2013	Pass.	Renault Clio	1461	55	Diesel	Manual	EURO5	1474	3.9
5	xxx	2013	Pass.	Renault Clio	1461	55	Diesel	Manual	EURO5	1448	4.1
6	xxx	2013	Pass.	Renault Clio	1461	55	Diesel	Manual	EURO5	1140	4.3
7	xxx	2013	Pass.	Suzuki Grand Vitara	1870	95	Diesel	Manual	EURO5	217	7.5
8	xxx	2013	Pass.	Jaguar XF	2720	204	Diesel	Automatic	EURO5	20	5.8
9	xxx	2013	Pass.	Audi A7	2967	180	Diesel	Automatic	EURO5	37	6.5
10	xxx	2013	Pass.	Audi A7	2967	180	Diesel	Automatic	EURO6	29	6.4
11	xxx	2013	Pass.	BMW 535	2993	230	Diesel	Automatic	EURO6	2	6.0
12	xxx	2013	Pass.	BMW 535	2993	230	Diesel	Automatic	EURO5	1	6.2
13	xxx	2013	Pass.	Jeep Grand Cherokee	2987	184	Diesel	Automatic	EURO5	97	8.1
14	xxx	2013	Pass.	BMW X6	2993	180	Diesel	Automatic	EURO5	61	8.0
15	xxx	2013	Pass.	Citroen C5	1560	84	Diesel	Manual	EURO5	286	5.2
16	xxx	2013	Pass.	Citroen C5	1560	84	Diesel	Automatic	EURO5	247	4.8
17											
18	Total average									6185	4.4
19											
20	<4									1986	3.8
21	4 to 5									3449	4.2
22	5 to 6									306	5.2
23	6 to 7									69	6.4
24	>7									375	7.7

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

Baseline – minimum data requirement

Number of sales in at least one past year by:

- Vehicle make and model (e.g. Toyota Corolla)
- Year of first registration
- Model production year (important for used imports)
- Engine displacement (liters or cubic centimeters)
- Engine power (kW or HP)
- Fuel type (e.g. gasoline, diesel, LPG, CNG, electricity)
- Rated fuel economy (Lge/100km, alternatively CO_2 emission, gCO_2/km) and test cycle basis (NEDC, FTP, JC08)

Baseline data – “nice to have”

Number of sales in at least one past year by:

- Transmission type (automatic, number of gears)
- Vehicle footprint (wheelbase x track width)
- Vehicle weight (mass in running order)
- Axle configuration (4x2, 4x4)
- Vehicle price

Baseline setting challenges

- **Level of detail available**
  - Accuracy depends on level of detail of registration database – ideally: Manufacturer, model, engine displacement, engine power, fuel, transmission
- **Used imports vs. new sales**
- **Availability of alternative sources to fill gaps, example: FE data by model**
  - FE data – EEA, EPA, Chinese government website…

Filling the fuel economy data

Country	Year	Vehicle Type	Model	Engine ccm	Engine kW	Fuel type	Transmission type	Emission standard	Vehicles registered	Final FE data, lge/100km
xxx	2013	Pass.	VW Polo	1199	55	Diesel	Manual	EURO5	614	4.1
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- **Targeted FE coverage: 85% of the newly registered cars**
- **Identification of the best selling 20 to 50 models (based on above criteria)**
- **Match with FE data sources**

Available FE data by model

Country	Source
Australia	Green Vehicle Guide Factsheets
	http://www.greenvehicleguide.gov.au
Brazil	Programa Brasiliero de Etiquetagem
	http://pbeveicular.petrobras.com.br/TabelaConsumo.aspx
Chile	Comparador de Autos
	http://www.consumovehicular.cl/?q=comparador
China	轻型汽车燃料消耗量通告 通告日期
	http://chinaafc.miit.gov.cn/n2257/n2280/index.html
European Union (EEA)	Monitoring of CO2 emissions from passenger cars – Regulation 443/2009
	http://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-8#tab-european-data
France	Consommation conventionnelles de carburant et émissions de gaz carbonique
	http://www2.ademe.fr/servlet/getDoc?cid=96&m=3&id=52820&p1=00&p2=12&ref=17597
Japan	自動車燃費一覧
	http://www.mlit.go.jp/jidosha/jidosha_fr10_000019.html
Mexico	Indicadores de Eficiencia Energética y Emisiones Vehiculares
	http://www.ecovehiculos.gob.mx/
Singapore	One Motoring Fuel Cost Calculator
	https://vrl.lta.gov.sg/lta/vrl/action/pubfunc?ID=FuelCostCalculator
South Korea	소비자 체감에 부합하는 새로운 연비표시 방법 확정
	http://bpms.kemco.or.kr/transport_2012/main/main.aspx
South Africa	COMPARATIVE PASSENGER CAR FUEL ECONOMY AND CO2 EMISSIONS DATA
	http://www.naamsa.co.za/ecelabels/
Switzerland	Automobil Revue catalogue
	http://katalog.automobilrevue.ch/
UK	Car Fuel Data Booklet
	http://carfueldata.direct.gov.uk/
	To download the data
	http://carfueldata.dft.gov.uk/downloads/
US	DoE / EPA Fuel Economy ratings
	http://www.fueleconomy.gov/
	To download the data
	http://www.fueleconomy.gov/feg/download.shtml

Source:

Draft guideline for fuel economy baseline-setting

Normalization of FE data – Test cycle conversion

Gasoline	Unit: gCO2 per km	NEDC to CAFE	CAFE	=	0.8658	*	NEDC	+	14.076
		CAFE to NEDC	NEDC	=	1.1325	*	CAFE	-	13.739
		JC08 to CAFE	CAFE	=	0.7212	*	JC08	+	36.736
		CAFE to JC08	JC08	=	1.2749	*	CAFE	-	38.423
		JC08 to NEDC	NEDC	=	0.8457	*	JC08	+	24.840
		NEDC to JC08	JC08	=	1.1430	*	NEDC	-	24.907
Diesel	Unit: gCO2 per km	NEDC to CAFE	CAFE	=	0.7683	*	NEDC	+	23.928
		CAFE to NEDC	NEDC	=	1.2209	*	CAFE	-	21.218
		JC08 to CAFE	CAFE	=	0.6050	*	JC08	+	44.338
		CAFE to JC08	JC08	=	1.3691	*	CAFE	-	38.393
		JC08 to NEDC	NEDC	=	0.8230	*	JC08	+	21.950
		NEDC to JC08	JC08	=	1.1720	*	NEDC	-	21.122

- **Three drive cycles are currently used to measure PLDV fuel economy:**
  - Europe – NEDC
  - United States – CAFE
  - Japan – JC08
- **Identical cars show different fuel economy values under different test cycles (up to 20% difference), hence results need to be normalized**

FE data – fuel conversion

L/100km to Lge/100km	Diesel	FE*1.08
Retrofit adjustment	CNG	FE*1.12
	LPG	FE*1.15

- **The first conversion factor accounts for the different energy densities of gasoline and diesel to convert L/100km to LGE/100km**
- **The retrofit adjustment accounts for the efficiency losses of cars when retrofitted to LPG or CNG.**

Thanks