ITRI
Industrial Technology
Research Institute

Vehicle Fuel Economy Regulation in Taiwan

Shin-Hui Lin (Emily)
Manager, Energy & Emission Research Dept.
Vehicle Homologation Division
Mechanical and Systems Research Laboratories

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OUTLINE

1. Background
2. History of Taiwan Vehicle FE Regulation
3. Taiwan Vehicle FE Regulation
4. Next Stage(2022+) of Taiwan Vehicle FE Regulation
5. Conclusion

Note: Fuel Economy (FE)

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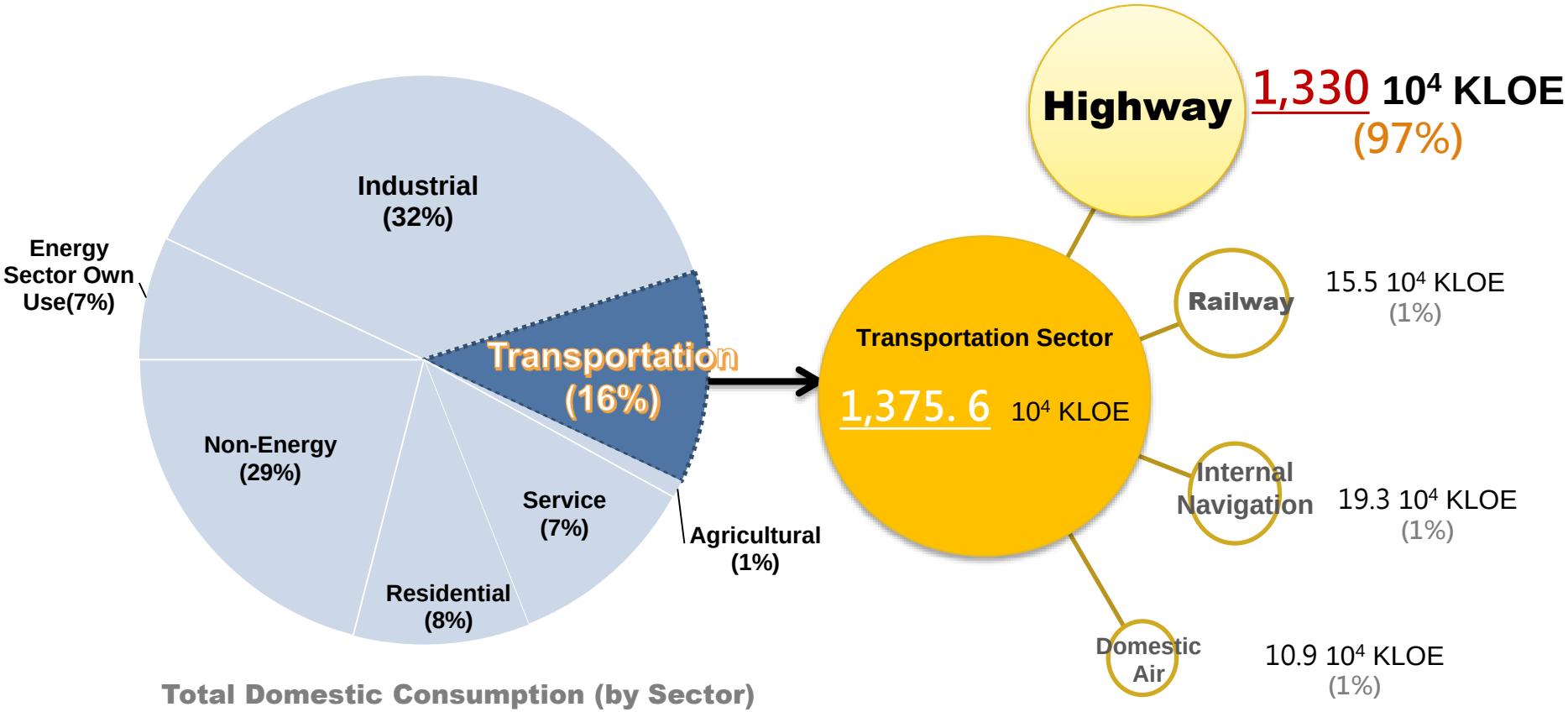
1 Background

Total Energy Consumption in Taiwan

- The amount of total Energy Consumption in 2017 was **11,727** 10^4 KLOE.



Total Domestic Consumption (by Sector)

Resource: Energy Statistical annual Reports, BOE

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Motorcycle in Taiwan

Limited Land Space

High Population Density

The most popular transportation mode in Taiwan

Warm Climate

Short distance between work location and residential area

by the end of 2016, over 13,700,000 motorcycles were registered in Taiwan.

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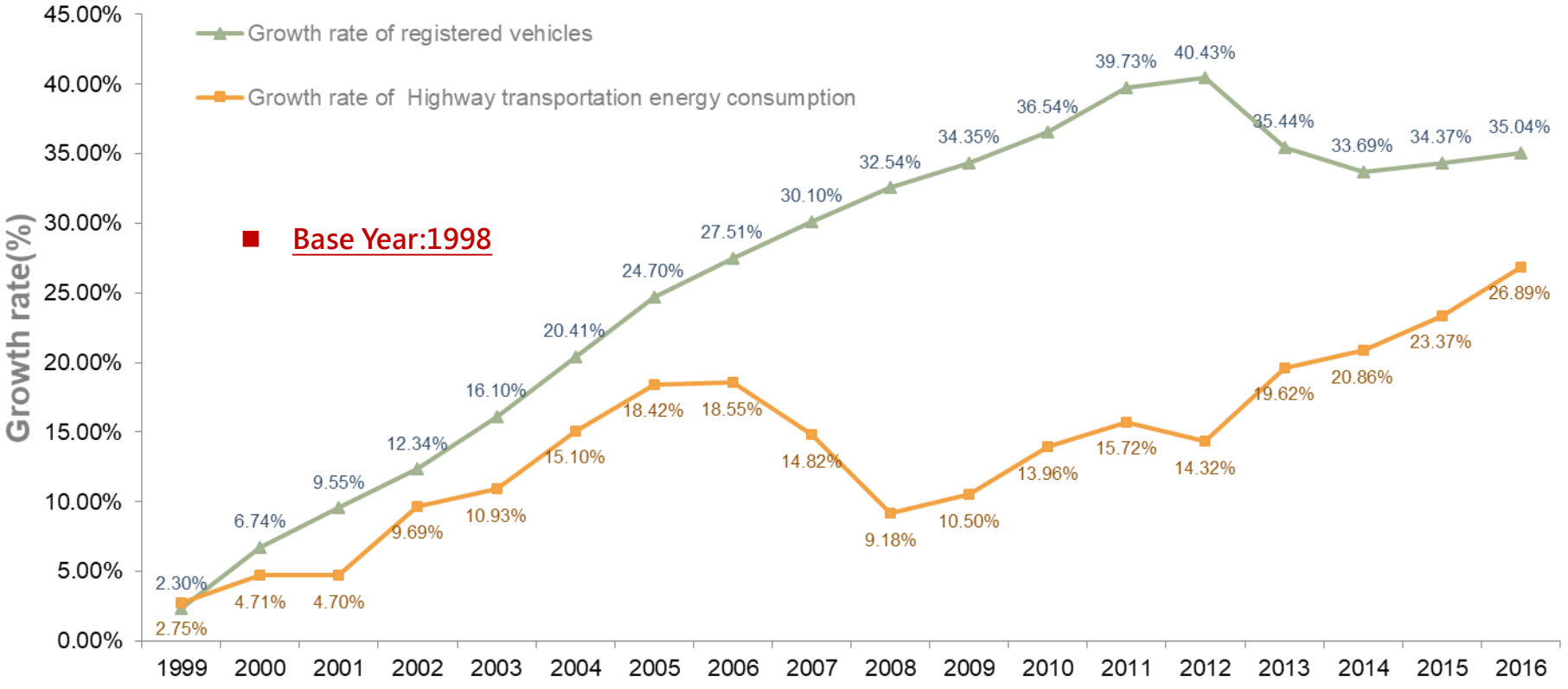
Number of Registered Vehicles and Fuel Consumption

The growth rate of vehicles fuel consumption is lower than the growth rate of registered vehicles in past decade.

- Implementation of vehicle energy efficiency management
- Economic factors
- Consumer purchasing decision factors (price, fuel efficiency, etc.)



(The Base Year:1998)

Resource: Energy Statistical annual Reports, BOE
Monthly Statistics of Transportation & Communications, MOTC

Taiwan New Vehicle Certification Agencies

Environmental Protection Administration(EPA)

→ **Emission and Noise**

行政院環境保護署
Environmental Protection Administration
Executive Yuan,R.O.C(Taiwan)

Bureau of Energy, Ministry of Economic Affairs, (BOE, MOEA)

→ **Fuel Economy**

經濟部能源局
Bureau of Energy ,
Ministry of Economic Affairs

Ministry of Transportation and Communications, (MOTC)

→ **Safety and License Plate**

MOTC MINISTRY OF TRANSPORTATION AND COMMUNICATIONS R.O.C.

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2 History of Taiwan Vehicle FE Regulation

Objects & Principle

Vehicle Type

Passenger Car (PC)
including Sedan & Station Wagons

Light Duty Truck (LDT)
with gross weight less than 2,500kg

Motorcycle (MC)
2 wheel & 3 wheel

Competent Authority

- **Bureau of Energy, Ministry of Economic Affairs**

Source of the regulation

- **Article 15 of the Energy Management Law**

Contents

- **Vehicles which fail to conform to the permit standards of energy consumption set up by the central competent authority should be prohibited from importing or selling in the domestic market.**

Evolution of Taiwan FE Regulation

Authority:

BUREAU OF ENERGY
Ministry of Economic Affairs

Jan. 1988
Passenger car & motorcycle stage I FE standard
Passenger car (CNS2733) (7 weight classes)
Motorcycle (CNS3105) (hot start, 3 engine displacement classes)

Jul. 1990
Tightened Standards
•Passenger car

Aug. 1997
Tightened Standards
•Motorcycle

Jan. 1992
Harmonized with international test methods
Passenger Car (FTP-75)
(7 weight classes)

Jan. 2002
Tightened Standards
•Passenger car
•Motorcycle

Jan. 2002
Standards based on engine displacement classes
Passenger Car (FTP-75)
(7 Engine Displacement Classes)
Add more classes
Motorcycle
(Hot Start, 7 Engine Displacement Classes)
→ class 150c.c. and above was being added

Jul. 2004
LDT stage I FE Standard

Jan. 2004
Harmonized with international test methods
→Duel Standards
Passenger car (FTP-75,EU)

Aug. 4, 2009
Tightened Standards
•Passenger Car
•LDT
•Motorcycle

June 2007
Add more classes
Passenger car (8 engine displacement classes) → class 5400c.c. and above was being added

Jul. 2010
Mandatory Vehicle Fuel Efficiency Labeling Rating System

Aug. 4, 2009
Revised test methods
Motorcycle (cold start, 9 engine displacement classes)

Jan. 2016
CAFE FE Standard
→Motorcycle
(With min. requirement)

Jan. 2017
CAFE FE Standard
→Passenger Car , LDT
(With min. requirement)

Jan. 1, 2017
Revised test methods
Motorcycle (WMTC)

Amended date :Oct. 18, 2018

Jan, 2022
Next Stage CAFÉ FE Standard
(With min. requirement)
- **More difficult standard**
- **More Credits**
- **Eco innovation**
- **Update calculation formula** (from Oct. 18, 2018)

System Established
Management Adjusted
Standards Tightened

Note:
CAFE → Corporate Average Fuel Economy

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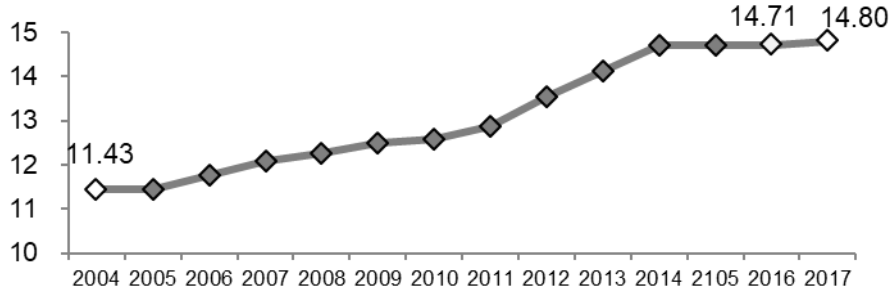
Trend of Fuel Economy on New Vehicles (2004~2017)

Fuel Economy (km/L)

Average Annual Growth Rate

Growth Rate (Basic Year：2004)

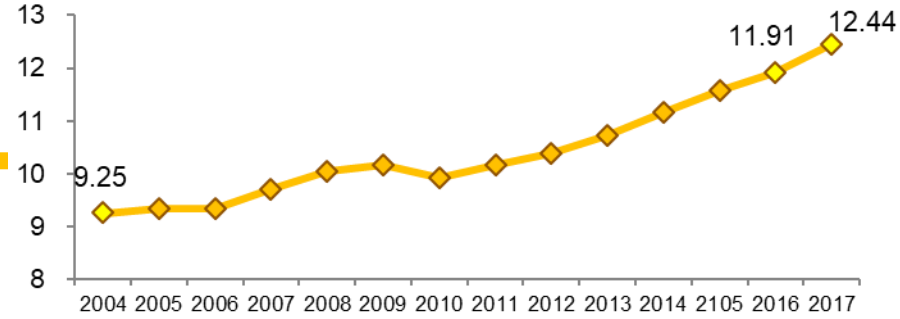
PC



2.02%

29%

LDT



2.32%

35%

MC

0.61%

8%

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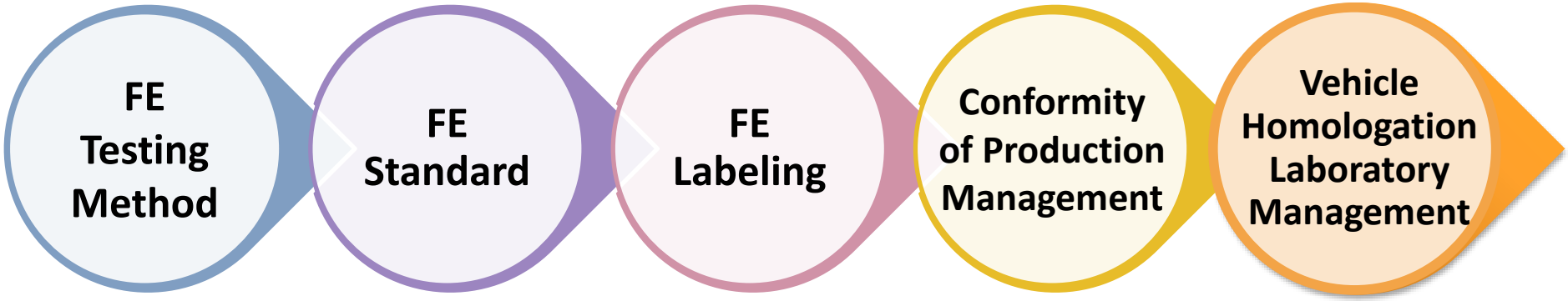
3 Taiwan Vehicle FE Regulation



Fuel Economy Testing Methods

Passenger Car & Light Duty Truck

1 Min. Requirement

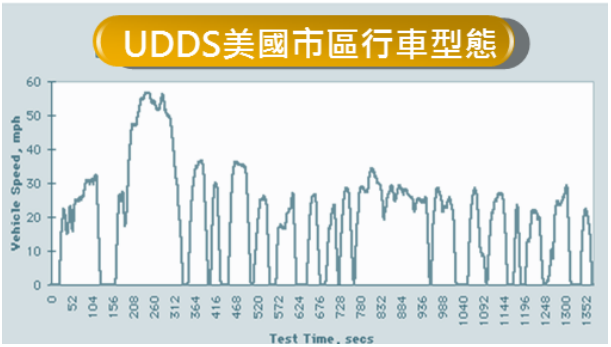
Any vehicle (PC and LDT) shall get one of following FE testing Methods and meet the FE standard.

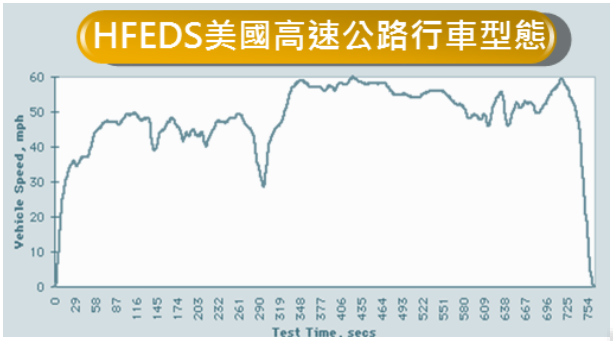
- NEDC or FTP-75.

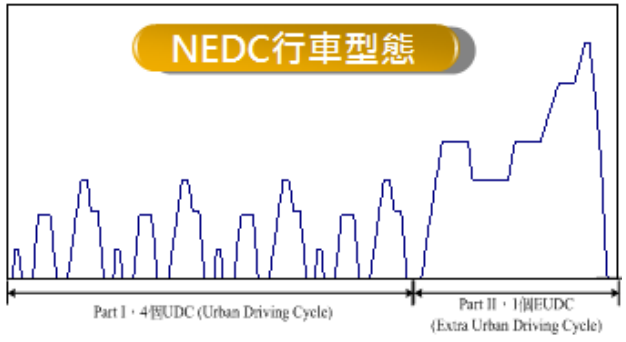
Engine Displacement (c.c.)	Passenger Car		LDT	
	FE Standard (min. requirement) (km/L) Federal Test Procedure (FTP-75) of the United States	FE Standard (min. requirement) (km/L) Directive 1999/100/EC and subsequent amendments	FE Standard (min. requirement) (km/L) Federal Test Procedure (FTP-75) of the United States	FE Standard (min. requirement) (km/L) Directive 1999/100/EC and subsequent amendments
Below 1200	16.2	14.1	10.9	9.5
Over 1200 to 1800	13.0	11.3	9.9	8.6
Over 1800 to 2400	11.4	9.9	8.9	7.7
Over 2400 to 3000	10.0	8.7	8.6	7.5
Over 3000 to 3600	9.2	8.0	7.6	6.6
Over 3600 to 4200	8.5	7.4	7.0	6.1
Over 4200 to 5400	7.2	6.3	6.7	5.8
Over 5400	6.5	5.7	6.1	5.3

2 CAFE Requirement

- Only NEDC.
- Shall Comply with CAFE FE standard.







Federal Test Procedure (FTP-75) of the United States

Directive 1999/100/EC and subsequent amendments

Vehicle Fuel Economy Standard

Passenger Car

FE Standard(min. requirement) (Passenger Car)

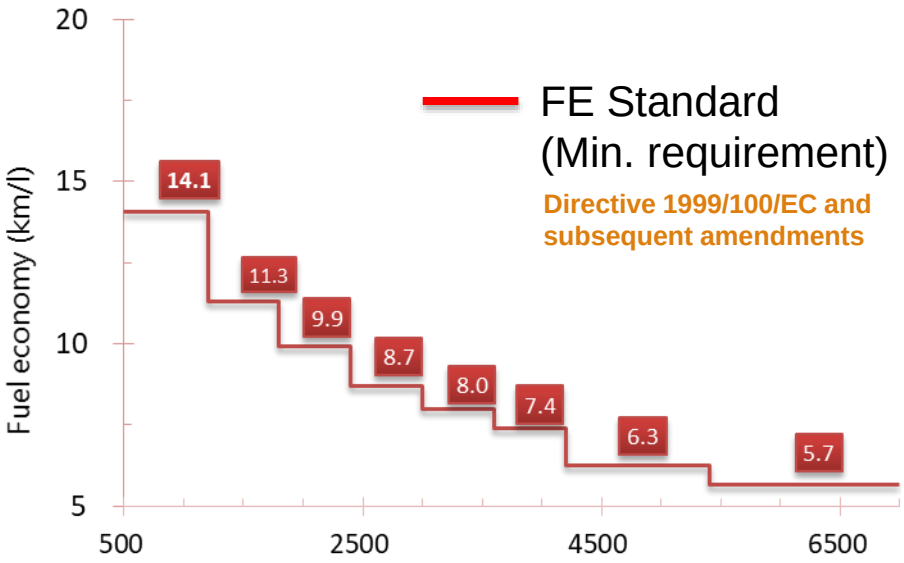
Fuel Efficiency Improvement

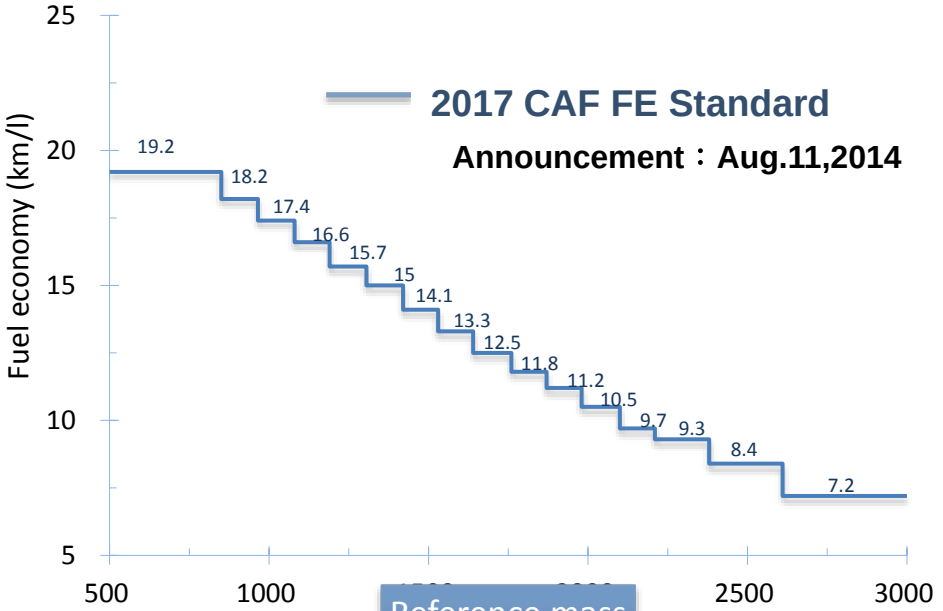
2017 FE Standard (incl. CAFE) (Passenger Car)

min. requirement

CAFE Effective Date： Jan.1, 2017

Any passenger car manufactured or imported by any entity shall comply with the following Fuel Economy Standards:





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Taiwan Vehicle Fuel Economy Standard

Light Duty Truck

FE Standard(min. requirement) (LDT)

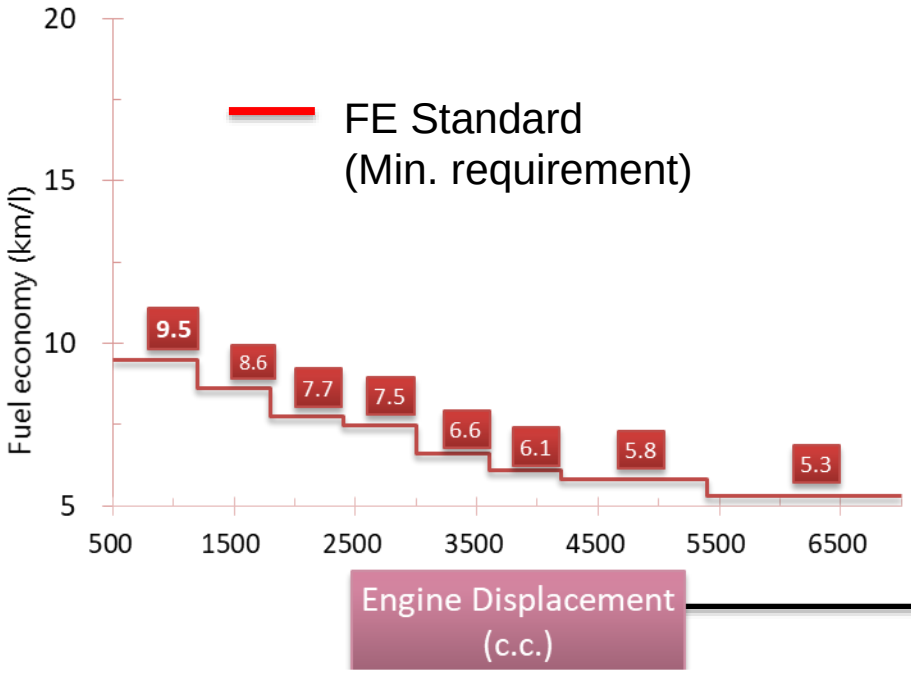
Fuel Efficiency Improvement

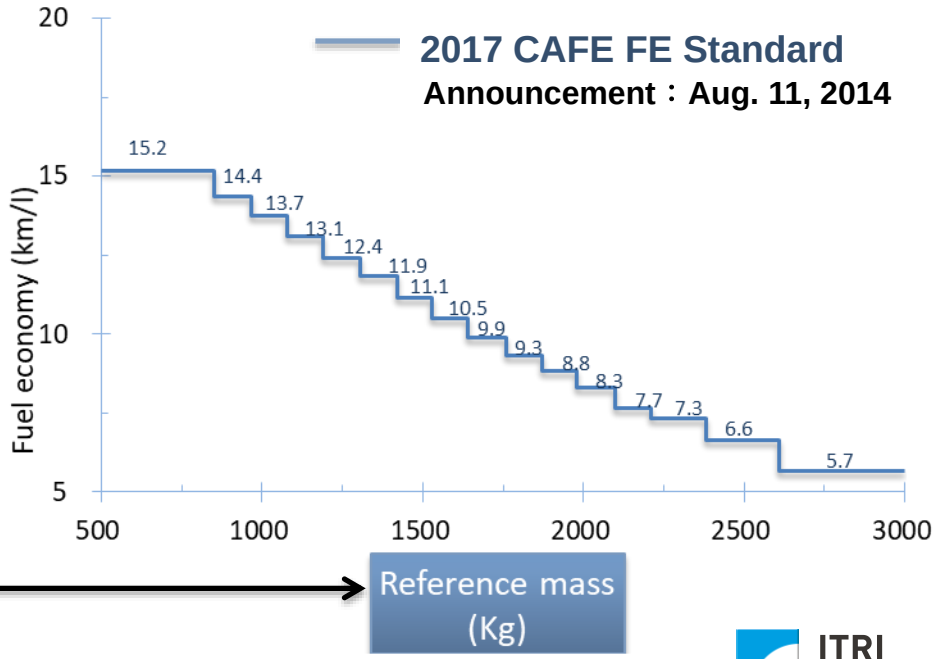
2017 FE Standard (incl. CAFE) (LDT)

min. requirement

CAFE Effective Date： Jan.1, 2017

Any passenger car manufactured or imported by any entity shall comply with the following Fuel Economy Standards:





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Fuel Economy Testing Methods

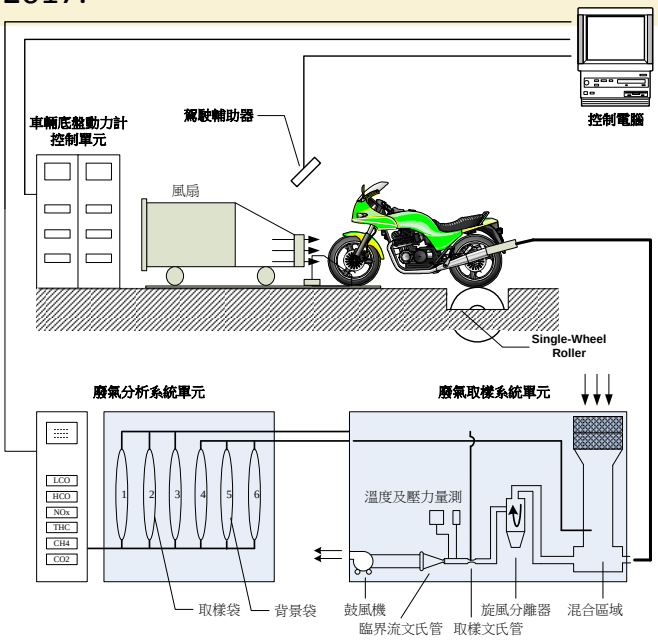
Motorcycle

How to calculate FE of motorcycle?

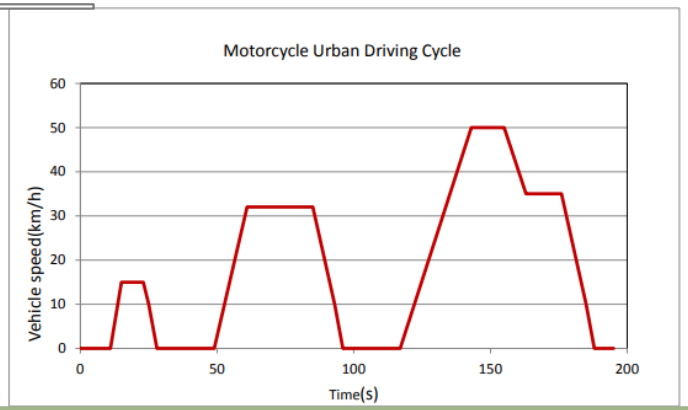
$$Fuel\ Economy(km/l) = \frac{1}{\frac{0.6}{City\ FE} + \frac{0.4}{Constant \cdot speed \cdot FE}}$$

To be consistent with EPA emission regulation, transfer the urban test methods of FE from ECE-R40 to WMTC(only Part1).

- A: the emission standards effective on and after Jan. 1, 2017.
- B: the emission standards effective prior to Jan. 1, 2017.

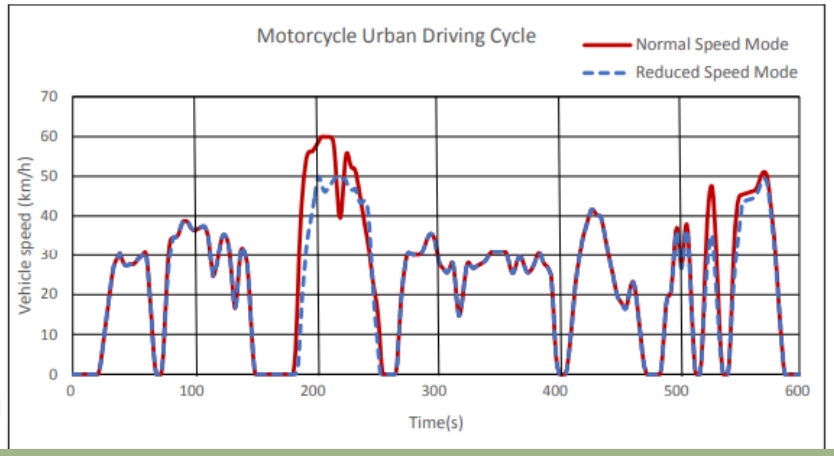


A



ECE-R40 (repeated 6 times)
(For motorcycles applicable to the emission standards effective prior to Jan. 1, 2017)

B



World Motorcycle Test Cycle (WMTC) Part 1
(For motorcycles applicable to the emission standards effective on and after Jan. 1, 2017)

Taiwan Vehicle Fuel Economy Standard

Motorcycle

FE Standard (Motorcycle) → Fuel Efficiency Improvement → **2016 FE Standard (incl. CAFE) (Motorcycle)**

Announcement：Aug. 11, 2014
Effective Date： Jan.1, 2016

Engine Displacement (c.c.)	FE Standard (min. requirement) (km/L)
Below 50	48.2
Over 50 to 100	40.6
Over 100 to 150	38.0
Over 150 to 250	28.0
Over 250 to 500	21.1
Over 500 to 750	16.6
Over 750 to 1000	15.8
Over 1000 to 1400	14.7
Over1400	13.1

Revise the class of engine displacement

Engine Displacement (c.c.)	2016 FE Standard (min. requirement) (km/L)	2016 CAFE Average fuel economy limits (km/L)
Below 50	48.2	54.5
Over 50 to 100	40.6	46.7
Over 100 to 150	38.0	43.8
Over 150 to 250	28.0	31.0
Over 250 to 500	21.1	26.5
Over 500 to 750	16.6	18.7
Over 750 to 1000	15.8	18.1
Over 1000 to 1250	14.7	15.8
Over 1250 to 1500	13.1	14.7
Over 1500	12.8	14.1

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Key Points of Taiwan Current CAFE Fuel Economy Standard

Effective Date：

- PC &LDT：Jan.1, 2017
- Motorcycle：Jan.1, 2016

AFEV ≧ AFETV

- The average fuel economy value (AFEV) of the manufacturer sold vehicles shall be higher than the required average fuel economy target value(AFETV).

How to Calculate CAFÉ

$$\text{AFETV} = \frac{\sum_{i=1}^{n} Annual\ sales}{\sum_{i=1}^{n}\left(\frac{Annual\ sales}{AFE\ limits}\right)}$$

$$\text{AFEV} = \frac{\sum_{i=1}^{n} Annual\ sales}{\sum_{i=1}^{n}\left(\frac{Annual\ sales}{FE\ testing\ value}\right)}$$

NEDC Test Procedure Only (for PC & LDT)

- Be tested in accordance with the test procedures prescribed in the European directive 1999/100/EC and its subsequent revisions.

Flexible Measures

- **Pooling & Credit Transfer.**
- **Electric vehicle credit:** economy test value could be multiplied by 2.5.
- **Carry forward of annual credit**: positive credits for next 3 years.
- **Different brands calculate CAFE separately**. (PC&LDT)
- **SVM Certification.**(PC)

SVM: Small volume manufacturer.

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Exceptions ⟸ Small volume manufacturer (Only for Passenger car)

The previous year sales of a brand by the vehicle entity were less than 300 units in Taiwan and the brand's world annual production is less than 10,000 units.

A proposal for its fuel economy improvement.

→ The proposal be submitted and being approved by the central competent authority.

→ To execute its improvement project announced by the central competent authority.

And not applicable for the average fuel economy limits prescribed herein.

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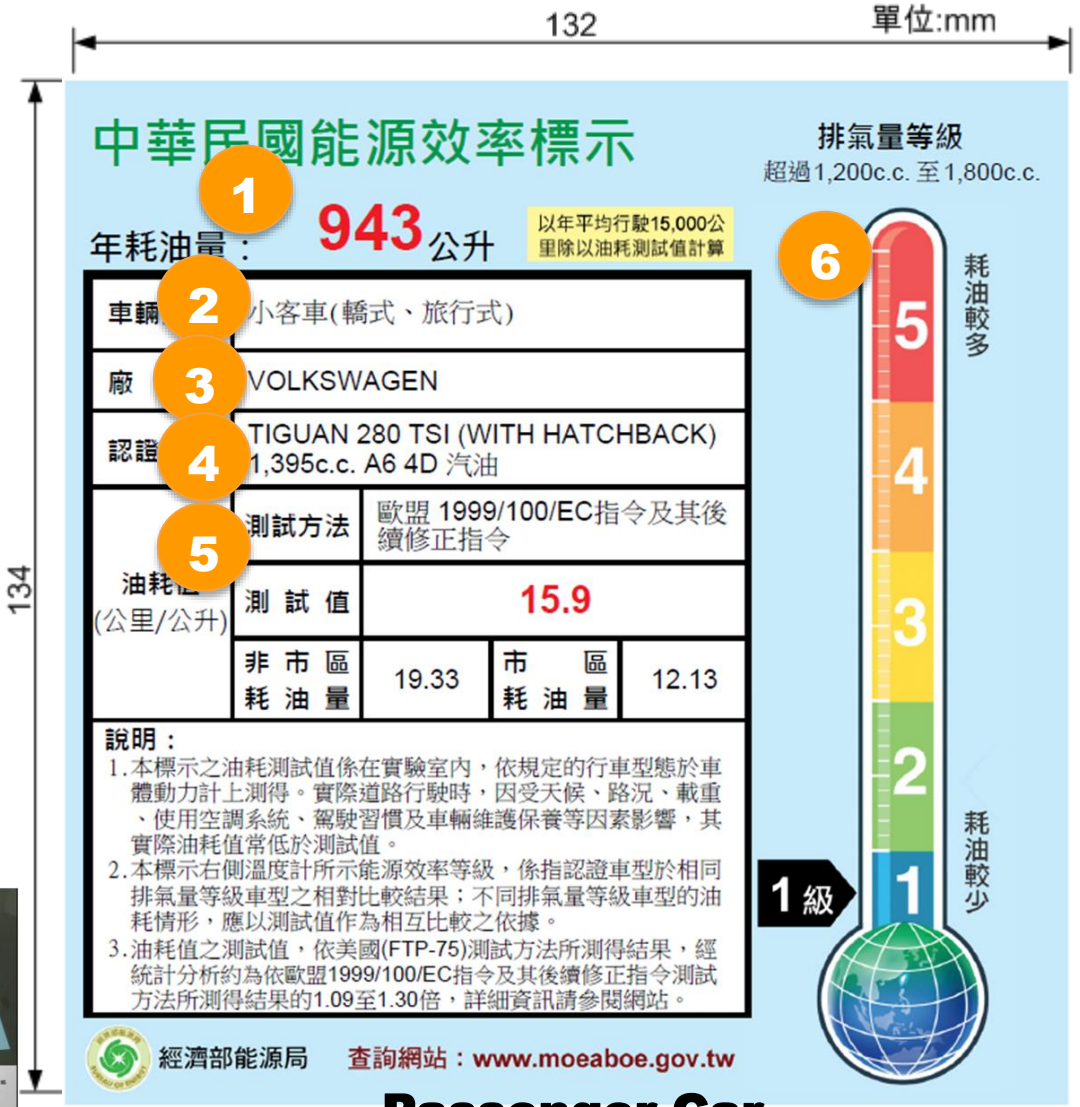
Taiwan Fuel Economy label

1. Annual fuel consumption
2. Vehicle type
3. Name of manufacturer
4. Certified vehicle model
5. Fuel economy:
   test procedure;
   combined fuel economy value;
   urban and extra-urban fuel economy. (For motorcycle :urban and constant-speed fuel economy)
6. The energy efficiency ranking



Passenger Car

Manufacturer & Importer

Conformity of Production (COP) Management

New Vehicle Random Testing

- new vehicles were being **random selected** and performed compliance tests.

Homologation Laboratory

Laboratory Management

Qualified FE Homologation Lab

- Certificate License of Accredited agency (test laboratory.
- Regular and unannounced laboratory inspection.
- Review the certification application.

污染排放分析儀

汽車污染及油耗測試

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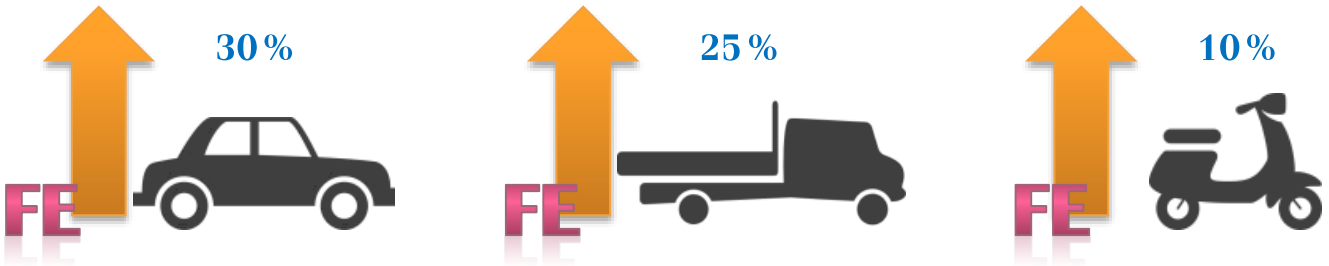
4 The Next Stage (2022+) of Vehicle FE Regulation

Amended Date: Oct. 18, 2018
Effective Date: Jan. 1, 2022



Note: The improvement percentage is compared to 2014.
Source: MOTC, “The White Book of Energy Transition in Transportation Sector”, 2017.

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Highlights of The Next Stage CAFE in TAIWAN

Effective Date	• **Jan.1, 2022**
Standard	• **Tightened CAFE FE Standard** • **(With the same min. requirement)**
Calculation	• **Reference to China, add the multiple in the existing formula, for super credit calculation.**

To extend the new technology of vehicle

More Flexible Measures

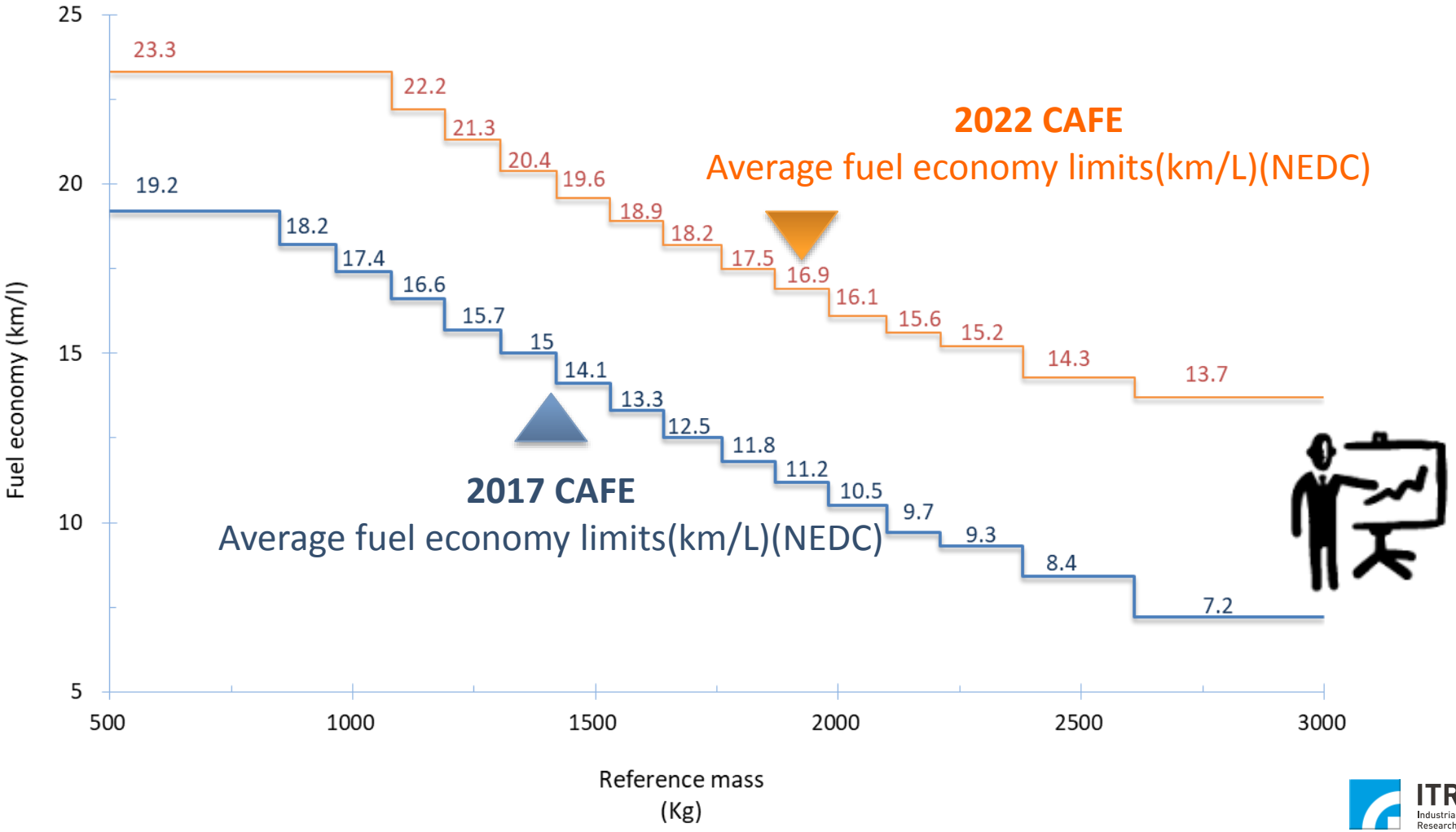
New Fuel Type vehicle Credit	• The amount of sales could be multiplied by a constant. • For PC & LDT (EV & Fuel Cell vehicle → 10, PHEV (with EV Range over 50 km → 5). • For Motorcycle (EV → 2.5).
Carry Forward Credit	• Positive credits for next 4 years.
Eco-innovation Credit	• Application of eco-innovation technology or product.

Higher FE vehicle Credit	• For PC, if FE value is higher than correspond 2022 average FE target, it's value could be multiplied the following constant.
	  • Over by 10% → set as 1.5; Over by 20% → set as 2;
	  • Over by 30% → set as 2.5; Over by 40% → set as 3;
	  • Over by 50% → set as 3.5;
	• For LDT, if it's FE value higher than 2022 average FE target of PC, the above is applicable.

Note:
New Fuel Type vehicle Credit & Carry Forward had implemented after amended date.

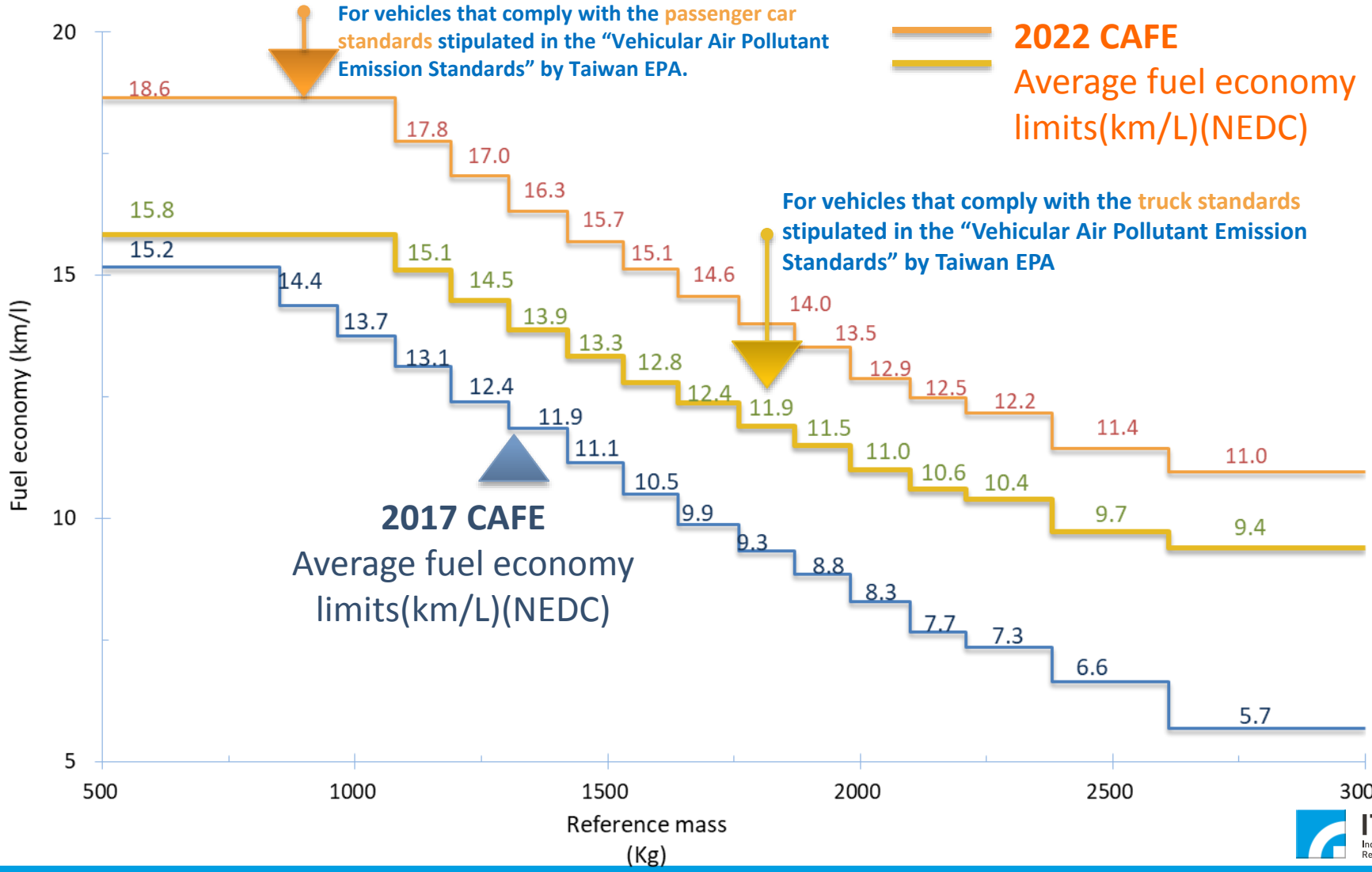
Taiwan 2022 CAFE Fuel Economy Standard

Passenger Car (Announcement : Oct. 18, 2018)



Taiwan 2022 CAFE Fuel Economy Standard

Light Duty Truck (Announcement : Oct. 18, 2018)



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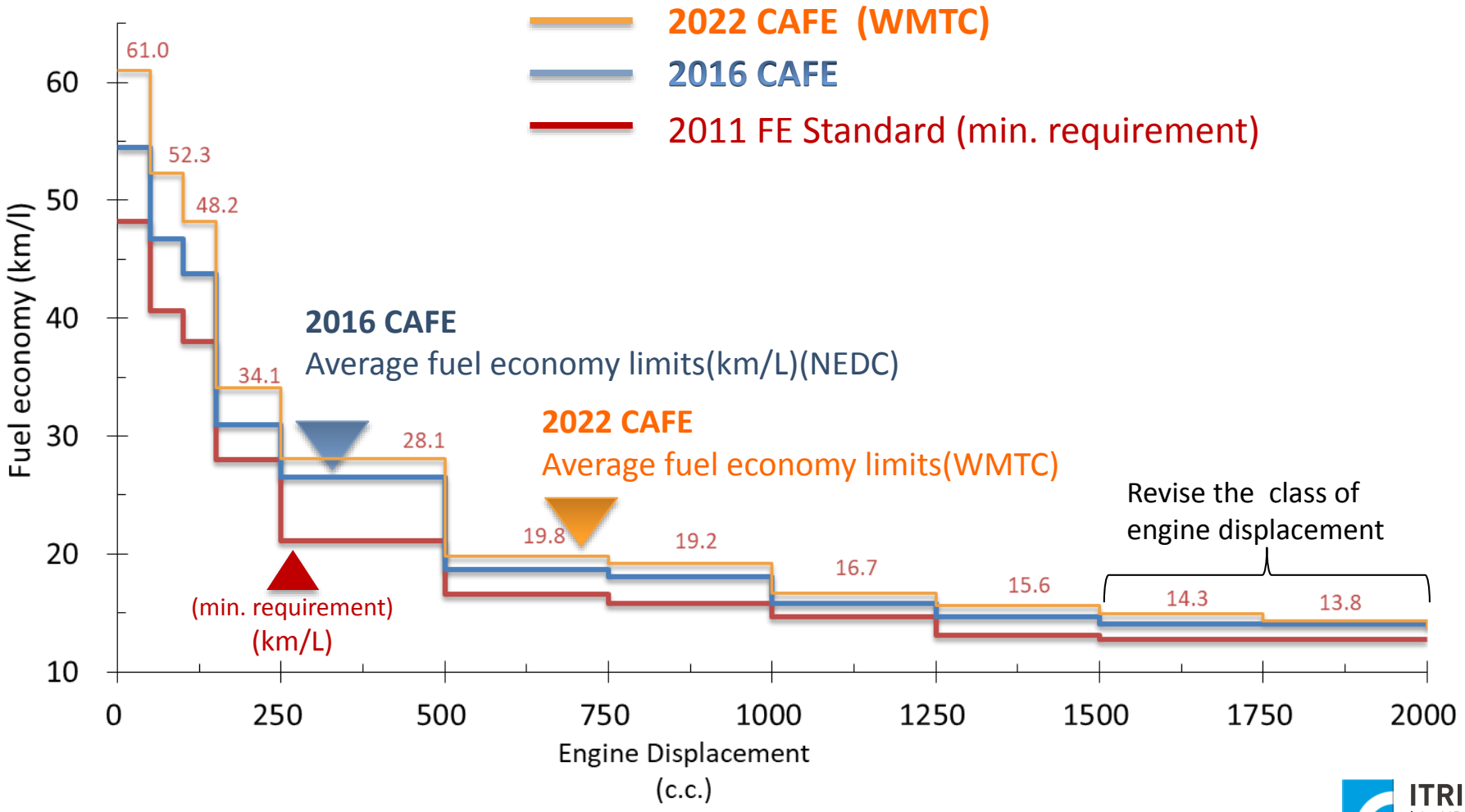
Taiwan 2022 CAFE Fuel Economy Standard

Motorcycle (Announcement : Oct. 18, 2018)



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How to Calculate Super Credit

Amended date: Oct. 18, 2018

Before

$$CAFE = \frac{\sum_{1}^{N} V_i}{\sum_{1}^{N} \frac{V_i}{FC_i}}$$

After

$$CAFE = \frac{\sum_{1}^{N} V_i \times W_i}{\sum_{1}^{N} \frac{V_i}{FC_i}}$$

i : manufactured or imported vehicle type's sequence number.

V_i : sales number (units) of manufactured or imported vehicle type i.

FC_i : fuel economy test value (km/L) for manufactured or imported vehicle type i.

EV	**Before Oct. 18, 2018**	Converse to fuel economy test value by specific conversion factors, and multiplied by 2.5.
	After Oct. 18, 2018	Converse to fuel economy test value by specific conversion factors.

W_i : Correspond Credit Multiplier for Vehicle Type i.

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5 Conclusion

Conclusion

- Vehicles play an important role in Taiwan society.
  - Taiwan government has well experience and good command handling vehicle fuel economy regulated issue.
  - Energy crisis and greenhouse gas issues push Taiwan government to set up more strict fuel economy regulation for vehicles.
- Incorporate CAFE system and more flexible administration scheme will help us achieve government energy saving goal without sacrificing local manufacturers' competitiveness.

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THANKS for YOUR ATTENTION

For further information, please feel free to contact with us by e-mail. EmilyLin@itri.org.tw

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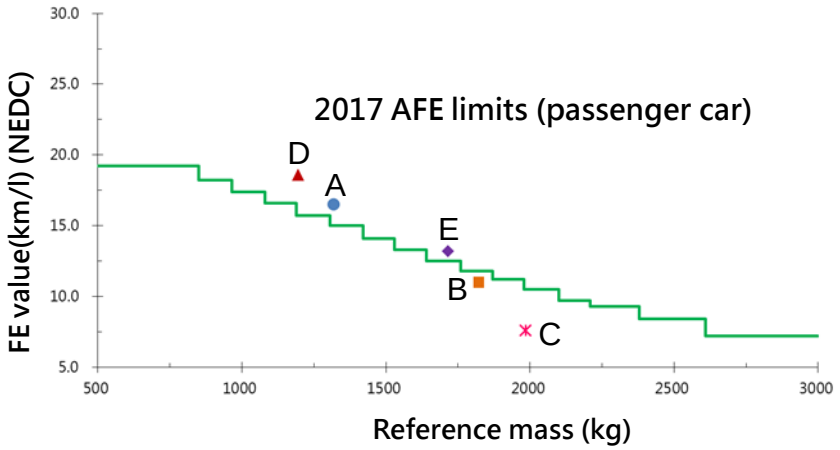
CAFE Example

- **Manufacturer: A**
- Year:2017

Model (type)	Annual Sales	Engine Displacement (c.c.)	Reference Weight (kg)	FE testing Value (NEDC) (km/L)	2017 Average fuel economy limits (km/L)
●A	18	1495	1319	16.5	15
■B	40	2996	1822	11	11.8
✳C	45	3999	1985	7.6	10.5
▲D	18	1497	1195	18.6	15.7
◆E	12	2494	1715	13.2	12.5



$$AFETV = \frac{\sum_{i=1}^{n} Annual\ sales}{\sum_{i=1}^{n}\left(\frac{Annual\ sales}{AFE\ limits}\right)}$$

$$AFEV = \frac{\sum_{i=1}^{n} Annual\ sales}{\sum_{i=1}^{n}\left(\frac{Annual\ sales}{FE\ testing\ value}\right)}$$

AFEV ≧ AFETV

- Year end date:2017/12/31
- Mfr. A's AFETV : 12.1 km/l
- Mfr. A's AFEV : 10.6 km/l
- Credits: - 1.5 (km/l)

When Credits<0, need to be controlled

- 2018 sales: Model A: 15 ; Model D: 32 ; Model E: 9
- Mfr. A's AFETV :12.8 km/l
- Mfr. A's AFE V:11.9 km/l
- Credits: -0.9(km/l)

- 2018 sales: Model A: 75 ; Model D: 99 ; Model E: 63
- Mfr. A's AFETV :13.6 km/l
- Mfr. A's AFEV:13.7 km/l
- Credits:+0.1(km/l)

Settlement of 2018
- Credits<0
- Credits>0

Re-Settlement

2017/12/31 — 2018/1/17 — 2018/6/5 — 2019/1/1

Only model A, D, E could be sold during this period.

All models could be sold when credits > 0

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