Vehicle Fuel Economy Regulation in Taiwan

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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)
1 Background
Total Energy Consumption in Taiwan

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

### Total Domestic Consumption (by Sector)

- **Transportation** (16%)
- **Industrial** (32%)
- **Non-Energy** (29%)
- **Service** (7%)
- **Residential** (8%)
- **Agricultural** (1%)

### Transportation Sector

- **Highway** $1,330 \times 10^4$ KLOE (97%)
- **Railway** $15.5 \times 10^4$ KLOE (1%)
- **Internal Navigation** $19.3 \times 10^4$ KLOE (1%)
- **Domestic Air** $10.9 \times 10^4$ KLOE (1%)

Resource: Energy Statistical annual Reports, BOE
Motorcycle in Taiwan

The most popular transportation mode 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.
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.)

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![Graph showing the growth rate of registered vehicles and highway transportation energy consumption from 1999 to 2016. The Base Year is 1998.](image)

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Resource: Energy Statistical annual Reports, BOE
Monthly Statistics of Transportation & Communications, MOTC
Taiwan New Vehicle Certification Agencies

- Environmental Protection Administration (EPA)
- Bureau of Energy, Ministry of Economic Affairs, (BOE, MOEA)
- Ministry of Transportation and Communications, (MOTC)
- Emission and Noise
- Fuel Economy
- Safety and License Plate
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

### Timeline

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

**Jan. 1992**
- Harmonized with international test methods
  - 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

**Aug. 1997**
- Tightened Standards
  - Motorcycle

**Jul. 1990**
- Tightened Standards
  - Passenger car

**Jan. 2002**
- Harmonized with international test methods → Dual Standards
  - Passenger Car (FTP-75,EU)
- Add more classes
  - Motorcycle (cold start, 9 engine displacement classes)
  - Passenger car (8 engine displacement classes) → class 5400c.c. and above was being added

**Jan. 2004**
- LDT stage I FE Standard

**Aug. 4, 2009**
- Revised test methods
  - Motorcycle (WMTC)
- Add more classes
  - Passenger car (6 engine displacement classes)

**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)

**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)

**Jan. 1, 2017**
- Revised test methods
  - Motorcycle

**Note:**
- CAFE → Corporate Average Fuel Economy
- System Established
- Management Adjusted
- Standards Tightened

**PC**

Fuel Economy (km/L)

- 2004: 11.43 km/L
- 2017: 14.80 km/L

Average Annual Growth Rate: 2.02%

Growth Rate (Basic Year: 2004): 29%

**LDT**

Fuel Economy (km/L)

- 2004: 9.25 km/L
- 2017: 12.44 km/L

Average Annual Growth Rate: 2.32%

Growth Rate (Basic Year: 2004): 35%

**MC**

Fuel Economy (km/L)

- 2004: 41.15 km/L
- 2017: 44.43 km/L

Average Annual Growth Rate: 0.61%

Growth Rate (Basic Year: 2004): 8%

CAFÉ standard
Taiwan Vehicle FE Regulation

- FE Testing Method
- FE Standard
- FE Labeling
- Conformity of Production Management
- Vehicle Homologation Laboratory Management
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.

<table>
<thead>
<tr>
<th>Engine Displacement (C.C.)</th>
<th>Passenger Car</th>
<th>LDT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FE Standard (min. requirement)</td>
<td>FE Standard (min. requirement)</td>
</tr>
<tr>
<td></td>
<td>(km/L)</td>
<td>(km/L)</td>
</tr>
<tr>
<td>Below 1200</td>
<td>16.2</td>
<td>14.1</td>
</tr>
<tr>
<td>Over 1200 to 1800</td>
<td>13.0</td>
<td>11.3</td>
</tr>
<tr>
<td>Over 1800 to 2400</td>
<td>11.4</td>
<td>9.9</td>
</tr>
<tr>
<td>Over 2400 to 3000</td>
<td>10.0</td>
<td>8.7</td>
</tr>
<tr>
<td>Over 3000 to 3600</td>
<td>9.2</td>
<td>8.0</td>
</tr>
<tr>
<td>Over 3600 to 4200</td>
<td>8.5</td>
<td>7.4</td>
</tr>
<tr>
<td>Over 4200 to 5400</td>
<td>7.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Over 5400</td>
<td>6.5</td>
<td>5.7</td>
</tr>
</tbody>
</table>

2 CAFE Requirement

- Only NEDC.
- Shall Comply with CAFE FE standard.
Any passenger car manufactured or imported by any entity shall comply with the following Fuel Economy Standards:

**FE Standard (Min. requirement)**

- Directive 1999/100/EC and subsequent amendments

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

- Effective Date: Jan. 1, 2017
- CAFE Effective Date: Aug. 11, 2014

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**Vehicle Fuel Economy Standard**

**Passenger Car**

- FE Standard (min. requirement) (Passenger Car)
- Fuel Efficiency Improvement

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**Engine Displacement (c.c.)**

**Reference mass (Kg)**

**2017 CAF FE Standard**

Announcement: Aug. 11, 2014

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**Fuel economy (km/l)**

- 14.1, 11.3, 9.9, 8.7, 8.0, 7.4, 6.3, 5.7

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**Reference mass (Kg)**

- 500, 1000, 1500, 2000, 2500, 3000

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**Fuel economy (km/l)**

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

**FE Standard (min. requirement)**

**2017 FE Standard (incl. CAFE)**

**LDT**

Effective Date: Jan. 1, 2017

Announcement: Aug. 11, 2014

<table>
<thead>
<tr>
<th>Engine Displacement (c.c.)</th>
<th>Reference mass (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500-1500</td>
<td>9.5, 8.6</td>
</tr>
<tr>
<td>1500-2500</td>
<td>7.7, 7.5</td>
</tr>
<tr>
<td>2500-3500</td>
<td>6.6, 6.1</td>
</tr>
<tr>
<td>3500-4500</td>
<td>5.8</td>
</tr>
<tr>
<td>4500-5500</td>
<td>5.3</td>
</tr>
<tr>
<td>5500-6500</td>
<td></td>
</tr>
</tbody>
</table>

**Fuel Economy (km/l)**

FE Standard (Min. requirement)
Fuel Economy Testing Methods

Motorcycle

How to calculate FE of motorcycle?

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

To be consistent with EPA emission regulation, transfer the urban test methods of FE from ECE-R40 to WMTC (only Part 1).

- B: the emission standards effective prior to Jan. 1, 2017.

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

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)

<table>
<thead>
<tr>
<th>Engine Displacement (c.c.)</th>
<th>FE Standard (min. requirement) (km/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 50</td>
<td>48.2</td>
</tr>
<tr>
<td>Over 50 to 100</td>
<td>40.6</td>
</tr>
<tr>
<td>Over 100 to 150</td>
<td>38.0</td>
</tr>
<tr>
<td>Over 150 to 250</td>
<td>28.0</td>
</tr>
<tr>
<td>Over 250 to 500</td>
<td>21.1</td>
</tr>
<tr>
<td>Over 500 to 750</td>
<td>16.6</td>
</tr>
<tr>
<td>Over 750 to 1000</td>
<td>15.8</td>
</tr>
<tr>
<td>Over 1000 to 1400</td>
<td>14.7</td>
</tr>
<tr>
<td>Over 1400</td>
<td>13.1</td>
</tr>
</tbody>
</table>

#### 2016 FE Standard (incl. CAFE) (Motorcycle)

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

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

*Revise the class of engine displacement*
### 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**

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

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

**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.
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.
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
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.
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.
**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.

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**To extend the new technology of vehicle**

- New Fuel Type vehicle Credit
- Carry Forward Credit
- Eco-innovation Credit
- Higher FE vehicle Credit

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**More Flexible Measures**

- 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).
- Positive credits for next 4 years.
- Application of eco-innovation technology or product.

- 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.

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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)

For vehicles that comply with the passenger car standards stipulated in the “Vehicular Air Pollutant Emission Standards” by Taiwan EPA.

For vehicles that comply with the truck standards stipulated in the “Vehicular Air Pollutant Emission Standards” by Taiwan EPA.
Taiwan 2022 CAFE Fuel Economy Standard
Motorcycle (Announcement: Oct. 18, 2018)

- 2022 CAFE (WMTC)
- 2016 CAFE
- 2011 FE Standard (min. requirement)

Average fuel economy limits (km/L) (NEDC)
- 2016 CAFE
  - 34.1
  - 28.1
  - (min. requirement) (km/L)
- 2022 CAFE
  - 19.8
  - 19.2
  - 16.7
  - 15.6
  - 14.3
  - 13.8

Revise the class of engine displacement
How to Calculate Super Credit

Amended date: Oct. 18, 2018

Before

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

After

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

$i$ : 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 $i$.

$W_i$ : Correspond Credit Multiplier for Vehicle Type $i$.

<table>
<thead>
<tr>
<th>EV</th>
<th>Before Oct. 18, 2018</th>
<th>After Oct. 18, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Converse to fuel economy test value by specific conversion factors, and multiplied by 2.5.</td>
<td>Converse to fuel economy test value by specific conversion factors.</td>
</tr>
</tbody>
</table>
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.
THANKS for
YOUR ATTENTION

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

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

<table>
<thead>
<tr>
<th>Model (type)</th>
<th>Annual Sales</th>
<th>Engine Displacement (c.c.)</th>
<th>Reference Weight (kg)</th>
<th>FE testing Value (NEDC) (km/L)</th>
<th>2017 Average fuel economy limits (km/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>18</td>
<td>1495</td>
<td>1319</td>
<td>16.5</td>
<td>15</td>
</tr>
<tr>
<td>B</td>
<td>40</td>
<td>2996</td>
<td>1822</td>
<td>11</td>
<td>11.8</td>
</tr>
<tr>
<td>☲C</td>
<td>45</td>
<td>3999</td>
<td>1985</td>
<td>7.6</td>
<td>10.5</td>
</tr>
<tr>
<td>☮D</td>
<td>18</td>
<td>1497</td>
<td>1195</td>
<td>18.6</td>
<td>15.7</td>
</tr>
<tr>
<td>☬E</td>
<td>12</td>
<td>2494</td>
<td>1715</td>
<td>13.2</td>
<td>12.5</td>
</tr>
</tbody>
</table>

- **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: 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: Re-Settlement
- Credits < 0: When Credits < 0, need to be controlled

- 2017 AFE limits (passenger car):
  - AFETV = \[ \frac{\sum_{i=1}^{n} \text{Annual sales}}{\sum_{i=1}^{n} \text{AFE testing value}} \]
  - AFEV = \[ \frac{\sum_{i=1}^{n} \text{Annual sales}}{\sum_{i=1}^{n} \text{AFE testing value}} \]

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

- 2017/12/31 2018/1/17 2018/6/5 2019/1/1
- All models could be sold when credits > 0