

**KINGDOM OF SAUDI ARABIA**

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**SAUDI STANDARDS, METROLOGY AND QUALITY ORGANIZATION**

**SASO**

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**SAUDI STANDARD  
DRAFT No. 29242/2014**

**SAUDI ARABIA CORPORATE AVERAGE FUEL ECONOMY STANDARD  
(SAUDI CAFE) FOR INCOMING LIGHT DUTY VEHICLES (2016 – 2020)**

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**SAUDI STANDARDS, METROLOGY AND  
QUALITY ORGANIZATION**

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**KR-2422**

**SAUDI ARABIA CORPORATE AVERAGE FUEL ECONOMY  
STANDARD (SAUDI CAFE) FOR INCOMING LIGHT DUTY VEHICLES  
(2016 – 2020))**

## **INTRODUCTION**

The objective of this standard is to set the fuel economy performance requirements for all light-duty vehicles (i.e. passenger cars and light trucks) incoming to the Kingdom of Saudi Arabia, which includes vehicles imported or vehicles locally produced for the intent of sale in the Kingdom of Saudi Arabia. This standard is part of Saudi Arabia's integrated approach to improve energy efficiency in the transportation sector.

The transportation sector is the second largest consumer of energy in the Kingdom of Saudi Arabia, and its consumption is projected to significantly grow in the foreseen future. In addition, the number of incoming light-duty vehicles over the next fifteen (15) years is expected to surpass the current on-the-road stock. As such, addressing the energy efficiency of this segment of vehicles is of utmost importance to the Kingdom of Saudi Arabia. This dictated the establishment of a fuel economy standard to achieve the objective.

This fuel economy standard will cover both new incoming vehicles and used import vehicles, ensure technology neutrality, equitable competitiveness and sustainable progressive targets taking into account the diversity of consumer demand and automobile manufacturers supply.

The fuel economy targets for new incoming light-duty vehicles were defined based on the corporate average concept and according to the utility of the vehicle in order to maintain the diversity of the market and its ability to cater for different consumer needs. The utility of the vehicle is described by two aspects: motor vehicle class and a representative vehicle attribute. As such, two different sets of targets were established for passenger cars and light trucks given the shear difference in the consumer utility for these two motor vehicle classes. In addition, the fuel economy targets for each vehicle class were defined according to the vehicle footprint (average track width multiplied by the wheelbase). Footprint was selected, as opposed to weight, to allow automotive manufacturers to effectively utilize light-weighting technologies.

The aim of this standard is to incentivize the automotive manufacturers to introduce the latest energy efficiency technologies to the Kingdom of Saudi Arabia, and reduce the supply of vehicles equipped with inferior technologies to the market.

For new incoming vehicles, automotive manufacturers will be allowed to average the fuel economy over their whole incoming fleet rather than having to meet the targets for each vehicle individually.

Automotive manufacturers would, therefore, be required to ensure that the average fuel economy for all the new incoming vehicles (i.e. imported or locally produced for the intent of sale in the Kingdom of Saudi Arabia) does not fall below the average fuel economy targets for those vehicles. This requirement shall commence on January 1, 2016 and shall be enforced on a 12-months cycle.

The standard allows for multiple flexibilities for allowing automotive manufacturers to meet their fuel economy targets. Automotive manufacturers will be able to accumulate fuel economy credits that would be generated from exceeding the fuel economy targets for a given enforcement cycle. The validity of the fuel economy credits shall be limited to five (5) enforcement cycles. In addition, automotive manufacturers will be able to carry-back deficits that would be generated in cases of non-compliance. Automotive manufacturers could also transfer generated and accumulated credits between the two motor vehicle classes in order to achieve compliance. SASO has established a Data sharing program in order to enhance its current vehicle database. Finally, automotive manufacturers participating in the Data Sharing Program would also be eligible to receive additional flexibility mechanisms.

The fuel economy targets for used import vehicles are defined as absolute minimum fuel economy per vehicle independent of its attribute. Two separate targets were set for each motor vehicle class (i.e. passenger cars and light trucks).

The Kingdom of Saudi Arabia's sole interest of setting the fuel economy standard is to curtail the inefficient domestic demand growth for transportation fuels. Therefore, an enforcement mechanism that would ensure all imported and locally produced vehicles meet the requirements set forth by the fuel economy standard.

A thorough review of the standard should be completed and shared with all stakeholders, including automotive manufacturers and importers, before December 31, 2018. The review shall yield the fuel economy targets for the period extending from 2021 until 2025, addition or removal of flexibility mechanisms and the potential changes to enforcement and implementation mechanisms.

**SAUDI ARABIA CORPORATE AVERAGE FUEL ECONOMY  
STANDARD (SAUDI CAFE) FOR INCOMING LIGHT DUTY VEHICLES (2016 – 2020)**

## **1- SCOPE AND FIELD OF APPLICATION**

This regulation defines the Saudi Arabia corporate average fuel economy standard (SAUDI CAFE) for all light duty vehicles (new vehicles and used import vehicles) incoming to the Kingdom of Saudi Arabia. This standard covers the period extending from January 1, 2016 until December 31, 2020.

## **2- COMPLEMENTARY REFERENCES**

2.1 SASO 2847/2013 “fuel economy labeling requirements of all new light duty vehicles”.

## **3- DEFINITIONS**

### **3.1. Vehicle definitions for the purpose of this standard**

#### **3.1.1. Light duty vehicles (LDVs)**

Vehicles with a maximum vehicle weight of 3,500 KGS and which are primarily used to transport passengers or goods.

#### **3.1.2. Passenger car**

A passenger car is any light duty vehicle (other than a car capable of off-highway operation) manufactured primarily for use in the transportation of no more than 10 individuals.

“Passenger cars” is the first of the two motor vehicle classes.

#### **3.1.3. Light truck**

A light truck is any light duty vehicle that is not a passenger car or a work truck and includes vehicles described in paragraphs 3.1.3.1 and 3.1.3.2 of this section:

3.1.3.1. A light duty vehicle designed to perform at least one of the following functions:

3.1.3.1.1 Transport more than 10 persons.

3.1.3.1.2 Provide temporary living quarters.

3.1.3.1.3 Transport property on an open bed.

- 3.1.3.1.4 Provide, as sold to the first retail purchaser, greater cargo-carrying than passenger-carrying volume, such as in a cargo van. If a vehicle is sold with a second-row seat, its cargo-carrying volume is determined with that seat installed, regardless of whether the manufacturer has described that seat as optional.
- 3.1.3.1.5 Permit expanded use of the automobile for cargo-carrying purposes or other non-passenger-carrying purposes through:
- 3.1.3.1.5.1 For non-passenger automobiles manufactured prior to model year 2012, the removal of seats by means installed for that purpose by the automobile's manufacturer or with simple tools, such as screwdrivers and wrenches, so as to create a flat, floor level, surface extending from the forwardmost point of installation of those seats to the rear of the automobile's interior.
- 3.1.3.1.5.2 For non-passenger automobiles manufactured in model year 2008 and beyond, the vehicles equipped with at least 3 rows of designated seating positions as standard equipment, permit expanded use of the automobile for cargo-carrying purposes or other nonpassenger-carrying purposes through the removal or stowing of foldable or pivoting seats so as to create a flat, leveled cargo surface extending from the forwardmost point of installation of those seats to the rear of the automobile's interior.
- 3.1.3.2 An automobile capable of off-highway operation, as indicated by the fact that it:
- 3.1.3.2.1 Has 4-wheel drive or is rated at more than 2,721.5 KGS maximum vehicle weight.
- 3.1.3.2.2 Has at least four of the following characteristics calculated when the automobile is at curb weight, on a level surface, with the front wheels parallel to the automobile's longitudinal centerline, and the tires inflated to the manufacturer's recommended pressure.
- 3.1.3.2.2.1 Approach angle of not less than 28 degrees.
- 3.1.3.2.2.2 Breakover angle of not less than 14 degrees.
- 3.1.3.2.2.3 Departure angle of not less than 20 degrees.
- 3.1.3.2.2.4 Running clearance of not less than 20 centimeters.
- 3.1.3.2.2.5 Front and rear axle clearances of not less than 18 centimeters each.

“Light trucks” is the second of the two motor vehicle classes.

### **3.1.4. New vehicle**

Any light duty vehicle that fits all of the following criteria:

- 3.1.4.1 Has a model year that is one year older, matches or exceeds the current cycle year.
- 3.1.4.2 Has not been driven for more than 1,000 km.

### **3.1.5. Used import vehicle**

Any light duty vehicle that fits any of the following criteria:

3.1.5.1 Has a model year that is at least two years older than the current cycle year.

3.1.5.2 Has been driven for more than 1,000 km.

### **3.1.6. Vehicle intended for sale in the Kingdom of Saudi Arabia**

Any light duty vehicle imported or locally produced for the intent of sale in the Kingdom of Saudi Arabia.

Imported light duty vehicles should have received a Customs clearance card at the point of entry to the Kingdom and should not be re-exported within the same enforcement cycle prior to registration in the Kingdom of Saudi Arabia.

## **3.2. Entity definitions for the purpose of this standard**

### **3.2.1. Saudi Energy Efficiency Center (SEEC)**

The entity which was established through Council of Ministers decree 363 / 2010 and acts as the custodian of demand-side energy efficiency in the Kingdom of Saudi Arabia.

### **3.2.2. Saudi Standards Metrology and Quality Organization (SASO)**

The entity which is responsible for issuing and updating standards specific to the Kingdom of Saudi Arabia. SASO will also maintain the “SASO fuel economy database” which will supply the fuel economy values for all vehicles that are approved for sales in the Kingdom of Saudi Arabia.

### **3.2.3. Gulf Cooperation Council Standards Organization (GSO)**

The entity which is responsible for granting the Model Type Approval (MTA).

### **3.2.4. Saudi Arabia Customs**

The entity which is responsible for control of incoming goods, tariff definition and collection at the borders of the Kingdom of Saudi Arabia.

### **3.2.5. General Department of Traffic – Ministry of Interior**

The entity which is responsible for vehicle registration and for owning the registry database in the Kingdom of Saudi Arabia.

### **3.2.6. Ministry of Commerce and Industry (MoCI)**

The ministry, which is responsible for market surveillance and laboratories registry in the Kingdom of Saudi Arabia.

### **3.2.7. Vehicle Importer**

Any entity importing vehicles to the Kingdom of Saudi Arabia.

### **3.2.8. Automotive manufacturer**

Any entity involved in the manufacturing vehicles for export and sales in the Kingdom of Saudi Arabia.

### **3.2.9. Fuel Economy Committee**

A committee formed from representatives of SEEC, SASO, Ministry of Transport (MoT), General Department of Traffic and GSO and which convenes on quarterly basis (or as required) to assess the impact of the fuel economy standard, proposes modifications as seen necessary and resolve any elevated disputes.

### **3.2.10. Saudi Arabia fuel economy software**

Saudi Arabia fuel economy software is software shared between MoCI, SEEC and SASO and is intended for the following activities:

- a. Entry of supply plans by automotive manufacturers.
- b. Actual fuel economy and target fuel economy calculation for each automotive manufacturer.
- c. Review of compliance for each automotive manufacturer at the end of each enforcement cycle.

## **3.3. Additional definitions for the purpose of this standard**

### **3.3.1. Model Type Approval (MTA)**

A Model Type Approval is a type approval certificate issued by GSO.

### **3.3.2. Vehicle footprint**

The vehicle footprint is the area between the four wheels of the vehicle. It is determined by multiplying the vehicle's wheelbase by the average of the vehicle's front and rear track widths. A sample representation of a vehicle's footprint is provided in Figure-1.

The vehicle footprint is expressed in square meters and should be reported to the third decimal point<sup>1</sup> e.g. 4.321 m<sup>2</sup>

### **3.3.3. Model year**

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<sup>1</sup> If the fourth decimal point in the footprint value of the vehicle is 5 or higher, the automotive manufacturer should round-up. For example, a vehicle that has a footprint of 4.3266 m<sup>2</sup> shall be reported as 4.327 m<sup>2</sup>. If fourth decimal point in the footprint value of the vehicle is 4 or lower, the automotive manufacturer should round-down. For example, a vehicle that has a footprint of 4.3264 m<sup>2</sup> shall be reported as 4.326 m<sup>2</sup>.

The period starting with the first production of the new model and lasting until the following model is introduced. This period shall not exceed 24 months terminating by the end of the last month of the calendar year by which the model is designated.

#### **4- DETAILED DESCRIPTION OF THE STANDARD for NEW INCOMING VEHICLES**

The fuel economy standard for new incoming vehicles in the Kingdom of Saudi Arabia is based on the corporate average concept. The technical details of the standard are explained below:

##### **4.1. The enforcement date**

The standard shall be effective as of January 1, 2016 and shall last until December 31, 2020.

##### **4.2. The attribute-based target curves**

An attribute-based target curve is defined as a curve linking the fuel economy target of the vehicle to one of its attributes (e.g. weight, engine displacement or footprint).

The target curves of the here-mentioned fuel economy standard for new incoming vehicles are defined as a function of the footprint of the vehicle.

While all the aforementioned attributes were considered, and although the weight is the most adopted vehicle attribute globally, the attribute of the corporate average standard for new incoming vehicles in the Kingdom of Saudi Arabia is set as the footprint. Footprint was deemed the most effective attribute due to weight and engine downsizing incentives. Reducing weight and engine displacement are two effective means to improve the vehicle fuel economy. However, automotive manufacturers are less incentivized to reduce the attribute value (i.e. weight or engine displacement) under the same attribute-based standard. For example, light weighting would require the automotive manufacturer to meet a stricter target, as lighter vehicles need to achieve higher fuel economy targets. However, under a footprint-based standard the target fuel economy would not change while improving the fuel economy. As such, the manufacturer can fully benefit from its light-weighting technology investment.

Each motor vehicle class (i.e. passenger cars and light trucks) shall have its own target curve.

All new incoming light duty vehicles shall be classified as either passenger cars or light trucks. Each new incoming vehicle shall be accounted under either the passenger cars target curve or the light trucks target curve.

The footprint-based target curves shall be increased on an annual basis to ensure progressive energy efficiency improvement and achieve a higher market average fuel economy.

##### **4.3. The enforcement cycles**

The first year curves (2016 year curves) shall be adopted between January 1, 2016 and December 31, 2016 (enforcement cycle #1).



The second year curves (2017 year curves) shall be adopted between January 1, 2017 and December 31, 2017 (enforcement cycle #2).

The third year curves (2018 year curves) shall be adopted between January 1, 2018 and December 31, 2018 (enforcement cycle #3).

The fourth year curves (2019 year curves) shall be adopted between January 1, 2019 and December 31, 2019 (enforcement cycle #4).

The fifth year curves (2020 year curves) shall be adopted between January 1, 2020 and December 31, 2020 (enforcement cycle #5).

#### 4.4. The target curves

The target curves shall be expressed as mathematical functions depending on the vehicle footprint.

##### 4.4.1. The form of the passenger cars target curves

The mathematical function is detailed below:

$$\text{TARGET FUEL ECONOMY} = \frac{1}{\text{MIN}[\text{MAX}(c * \text{FOOTPRINT} + d, \frac{1}{a}), \frac{1}{b}]}$$

$a$  = fuel economy upper limit (km / liter),  $b$  = fuel economy lower limit (km / liter),  $c$  = slope (liter / km / square meter) and  $d$  = intercept (liter / km)

The parameters defining the proposed fuel economy target curves for passenger cars are introduced in the table below:

Coefficient	Jan 1, 2016 – Dec 31, 2016	Jan 1, 2017 – Dec 31, 2017	Jan 1, 2018 – Dec 31, 2018	Jan 1, 2019 – Dec 31, 2019	Jan 1, 2020 – Dec 31, 2020
<b>a (km / liter)</b>	15.28393	15.64530	16.04919	17.46917	18.54053
<b>b (km / liter)</b>	11.88277	12.09960	12.34193	13.16246	13.88095
<b>c (liter / km / square meter)</b>	0.013439	0.013439	0.013439	0.013439	0.012991
<b>d (liter / km)</b>	0.014247	0.012725	0.011114	0.006052	0.004460

##### 4.4.2. The form of the light trucks target curves

The mathematical function is detailed below:

**TARGET FUEL ECONOMY**

$$= \text{MAX} \left( \frac{1}{\text{MIN} \left[ \text{MAX} \left( c * \text{FOOTPRINT} + d, \frac{1}{a} \right), \frac{1}{b} \right]}, \frac{1}{\text{MIN} \left[ \text{MAX} \left( g * \text{FOOTPRINT} + h, \frac{1}{e} \right), \frac{1}{f} \right]} \right)$$

$a$  = fuel economy upper limit (km / liter),  $b$  = fuel economy lower limit (km / liter),  $c$  = slope (liter / km / square meter),  $d$  = intercept (liter / km),  $e$  = fuel economy upper limit (km / liter) of “floor”,  $f$  = fuel economy lower limit (km/liter) of “floor”,  $g$  = slope (liter / km / square meter) of “floor” and  $h$  = intercept (liter / km) of “floor”

The parameters defining the proposed fuel economy target curves for light trucks are introduced in the table below:

Coefficient	Jan 1, 2016 – Dec 31, 2016	Jan 1, 2017 – Dec 31, 2017	Jan 1, 2018 – Dec 31, 2018	Jan 1, 2019 – Dec 31, 2019	Jan 1, 2020 – Dec 31, 2020
<b>a (km / liter)</b>	12.67779	13.03916	13.34102	14.63346	15.41572
<b>b (km / liter)</b>	9.46796	9.66777	9.83358	10.51806	10.66686
<b>c (liter / km / square meter)</b>	0.011510	0.011510	0.011510	0.011510	0.013885
<b>d (liter / km)</b>	0.035047	0.032855	0.031107	0.024493	0.011989
<b>e (km / liter)</b>	1	1	1	1	14.92255
<b>f (km / liter)</b>	1	1	1	1	10.66686
<b>g (liter / km / square meter)</b>	0	0	0	0	0.011510
<b>h (liter / km)</b>	0	0	0	0	0.023171

## 4.5. Compliance with the standard

### 4.5.1. Responsible entities

Automotive manufacturers shall be held responsible for meeting the standard requirements for all new incoming vehicles (as defined in section 3.1.4).

### 4.5.2. Assessment of compliance

#### 4.5.2.1. Calculation of the fleet actual fuel economy

Each automotive manufacturer shall have an actual fuel economy value for its passenger cars fleet and another actual fuel economy value for its light trucks fleet.

The actual fuel economy value **CAFE actual** shall be a sales-weighted harmonic average of all vehicles' actual fuel economy values under that motor vehicle class.

$$CAFE_{actual} = \frac{\sum_i SALES_i}{\sum_i \frac{SALES_i}{ACTUAL FUEL ECONOMY_i}}$$

Where:

- a. CAFE *actual* is the actual Corporate Average Fuel Economy
- b. SALES<sub>i</sub> is the number of vehicles intended for sale within Saudi Arabia of each *i*<sup>th</sup> unique footprint within each model type as provided in the supply plan detailed below in section 6.1.1.2
- c. ACTUAL FUEL ECONOMY<sub>i</sub> is the reported actual fuel economy value of each *i*<sup>th</sup> unique footprint within each model type (as provided in the supply plan detailed below in section 6.1.1.2). It is important to mention that the vehicle at which the actual fuel economy is reported has to be representative of the actual vehicle sold in the Saudi market.

4.5.2.1.1 If the vehicle model is not included in the automotive manufacturer's supply plan, the vehicle shall be granted an actual fuel economy value based on "SASO fuel economy database".

4.5.2.1.2 If the vehicle model is not included in the automotive manufacturer's supply plan, and it is not available on the "SASO fuel economy database", the importer shall provide the model fuel economy based on the results of the tests conducted in a SASO or International Laboratory Accreditation Cooperation (ILAC) accredited laboratory.

Note: - Fuel Economy shall be measured based on the US Environmental Protection Agency testing procedures:

- EPA Federal Test FTP-75 for City Driving
- EPA Federal Test HWFET for Highway Driving

The Combined Fuel Economy (referred to hereafter as "fuel economy") shall be calculated per the following equation:

$$\text{Combined Fuel Economy} = 1 / [(0.55/\text{City Fuel Economy}) + (0.45/\text{Highway Fuel Economy})]$$

- A manufacturer may also test the fuel economy of a vehicle based on the New European Driving Cycle (NEDC) testing procedures. If the manufacturer elects to do so, then the Combined Fuel Economy values (km/liter) shall be derived by converting the NEDC combined driving test result using the conversions provided in Table-1.

- A manufacturer shall report the fuel economy value for any given vehicle in kilometer per liter rounded to the first decimal place<sup>2</sup>.

#### 4.5.2.2. Calculation of the fleet target fuel economy

Each automotive manufacturer shall have a target fuel economy value for its passenger cars fleet and another target fuel economy value for its light trucks fleet.

The target fuel economy value **CAFE target** shall be a sales-weighted harmonic average of all vehicles' target fuel economy values under the same motor vehicle class.

$$\text{CAFE target} = \frac{\sum_i \text{SALES}_i}{\sum_i \frac{\text{SALES}_i}{\text{TARGET FUEL ECONOMY}_i}}$$

Where:

- a. CAFE target is the target Corporate Average Fuel Economy
- b. SALES<sub>i</sub> is the number of vehicles intended for sale within Saudi Arabia of each i<sup>th</sup> unique footprint within each model type as provided in the supply plan detailed below in section 6.1.1.2
- c. TARGET FUEL ECONOMY<sub>i</sub> is the corresponding fuel economy target of each i<sup>th</sup> unique footprint within each model type as provided in the supply plan detailed below in section 6.1.1.2

The target fuel economy shall be determined for each i<sup>th</sup> unique footprint within each model type based on the target curve value that corresponds to the motor vehicle class and the footprint.

- 4.5.2.2.1 If the vehicle model is not included in the automotive manufacturer's supply plan, the vehicle shall be granted a footprint value based on "SASO fuel economy database".

#### 4.5.2.3. Determination of compliance

Determination of compliance shall be done separately for each of the two motor vehicle classes: passenger cars and light trucks.

##### 4.5.2.3.1. Credit / deficit system

A credit/deficit system will be established for each automotive manufacturer for each motor vehicle class i.e. each automotive manufacturer will have a credit/deficit account for passenger cars and another credit/deficit account for light trucks.

<sup>2</sup> If the hundredth decimal point in the fuel economy value of the vehicle is 5 or higher, the automotive manufacturer should round-up. For example, a vehicle that has a fuel economy of 11.35 km/l shall be reported as 11.4 km/l. If the hundredth decimal point in the fuel economy value of the vehicle is 4 or lower, the automotive manufacturer should round-down. For example, a vehicle that has a fuel economy of 12.54 km/l shall be reported as 12.5 km/l.

For the passenger cars motor vehicle class and in case of over-compliance (when the actual fuel economy of the passenger cars fleet exceeds the target average fuel economy of the passenger cars fleet), credits are generated and credited to the passenger cars account of the compliant entity.

For the passenger cars motor vehicle class and in case of non-compliance (when the actual fuel economy of the passenger cars is less than the target average fuel economy of the passenger cars fleet), credits are removed from the passenger cars account of the non-compliant entity.

For the light trucks motor vehicle class and in case of over-compliance (when the actual fuel economy of the light trucks fleet exceeds the target average fuel economy of the light trucks fleet), credits are generated and credited to the light trucks account of the compliant entity.

For the light trucks motor vehicle class and in case of non-compliance (when the actual fuel economy of the light trucks is less than the target average fuel economy of the light trucks fleet), credits are removed from the light trucks account of the non-compliant entity.

#### 4.5.2.3.2. Definition of compliance

An automotive manufacturer is considered compliant with the here-mentioned corporate average fuel economy standard at the end of the enforcement cycle “i”, if and only if both of the following conditions are satisfied:

- a.  $CREDITS_{manufacturer, passenger cars, enforcement cycle "i"} \geq 0$
- b.  $CREDITS_{manufacturer, light trucks, enforcement cycle "i"} \geq 0$

Where:

$$\begin{aligned}
 &CREDITS_{manufacturer, passenger cars, enforcement cycle "i"} \\
 &= [(CAFE ACTUAL PC - CAFE TARGET PC) * 10 * SALES PC] \\
 &+ CREDITS/DEFICITS_{accumulated} + CREDITS_{to PC} - CREDITS_{to LT}
 \end{aligned}$$

And:

$$\begin{aligned}
 &CREDITS_{manufacturer, light trucks, enforcement cycle "i"} \\
 &= [(CAFE ACTUAL LT - CAFE TARGET LT) * 10 * SALES LT] \\
 &+ CREDITS/DEFICITS_{accumulated} + CREDITS_{to LT} - CREDITS_{to PC}
 \end{aligned}$$

Where:

“CAFE ACTUAL PC” = CAFE ACTUAL manufacturer, passenger cars, enforcement cycle “i”

“CAFE TARGET PC” = CAFE TARGET manufacturer, passenger cars, enforcement cycle “i”

“SALES PC” = Number of passenger cars sold in the Kingdom during enforcement cycle “i”

“CAFE ACTUAL LT” = CAFE ACTUAL manufacturer, light trucks, enforcement cycle “i”

“CAFE TARGET LT” = CAFE TARGET manufacturer, light trucks, enforcement cycle "i"

“SALES LT” = Number of light trucks sold in the Kingdom during enforcement cycle "i"

“CREDITS/DEFICITS accumulated”= CREDITS/ DEFICITS accumulated from previous enforcement cycles

“CREDITS to PC”= CREDITS transferred from light trucks motor vehicle class to passenger cars motor vehicle class

“CREDITS to LT”= CREDITS transferred from passenger cars motor vehicle class to light trucks motor vehicle class

#### **4.5.2.3.3. Flexibility mechanisms**

The automotive manufacturer will be allowed to use the flexibilities detailed below:

##### **4.5.2.3.3.1 Credit carry forward**

In the case of over-compliance in an enforcement cycle “i”, the automotive manufacturer will be allowed to accumulate credits.

These credits can be used to achieve compliance in coming enforcement cycles by adding them to the balance of the credit/deficit systems of the respective motor vehicle class.

Credits generated shall be available to the automotive manufacturer for use in any of the five enforcement cycles after the enforcement cycle in which they were generated.

No limit shall be applied to the amount of accumulated credits that are carried forward within the timeframe specified above (five enforcement cycles): (i+1), (i+2), (i+3), (i+4), (i+5).

##### **4.5.2.3.3.2 Credit carry backwards**

Automotive manufacturers will be allowed to carry back deficits generated in any given enforcement cycle, for one subsequent enforcement cycle.

In case of non-compliance in enforcement cycle “i”, the automotive manufacturer will then be allowed a period of one enforcement cycle to offset the accumulated deficit

In case not enough credits are accumulated in the enforcement cycle subsequent to enforcement cycle “i” to offset all deficits generated (i.e. the automotive manufacturer still carries deficits in enforcement cycle “i+2”), the enforcement mechanism detailed in section 6.1.3.3 will be applied on the non-compliant automotive manufacturer.

An automotive manufacturer may not carry both credits and deficits simultaneously at any given enforcement cycle.

#### 4.5.2.3.3.3 Credit transfer across motor vehicle classes

The automotive manufacturer will be allowed to transfer credits (if available) from one motor vehicle class to another (i.e. from passenger cars to light trucks and vice-versa).

However, when transferred, credits need to be adjusted in order to ensure savings are preserved. Transferred credits between vehicle classes will be multiplied by an adjustment factor as per the below:

- a. A credit transfer from the passenger cars vehicle class to the light trucks vehicle class:

**ADJUSTMENT PC to LT =**

$$\frac{VKT_{pc, \text{ enforcement cycle "i"}} * CAFE_{ACTUAL}_{lt, \text{ enforcement cycle "i"}} * CAFE_{TARGET}_{lt, \text{ enforcement cycle "i"}}}{VKT_{lt, \text{ enforcement cycle "i"}} * CAFE_{ACTUAL}_{pc, \text{ enforcement cycle "i"}} * CAFE_{TARGET}_{pc, \text{ enforcement cycle "i"}}$$

- b. A credit transfer from the passenger cars vehicle class to the light trucks vehicle class:

**ADJUSTMENT LT to PC =**

$$\frac{VKT_{lt, \text{ enforcement cycle "i"}} * CAFE_{ACTUAL}_{pc, \text{ enforcement cycle "i"}} * CAFE_{TARGET}_{pc, \text{ enforcement cycle "i"}}}{VKT_{pc, \text{ enforcement cycle "i"}} * CAFE_{ACTUAL}_{lt, \text{ enforcement cycle "i"}} * CAFE_{TARGET}_{lt, \text{ enforcement cycle "i"}}$$

Where,

VKT<sub>pc, enforcement cycle "i"</sub> is the lifetime vehicle kilometers traveled for the passenger cars vehicle class during enforcement cycle "i" in which credits are transferred

VKT<sub>lt, enforcement cycle "i"</sub> is the lifetime vehicle kilometers traveled for the light trucks vehicle class during enforcement cycle "i" in which credits are transferred

CAFE ACTUAL<sub>pc, enforcement cycle "i"</sub> is the actual fuel economy in the passenger cars vehicle class during enforcement cycle "i" in which credits are transferred

CAFE ACTUAL<sub>lt, enforcement cycle "i"</sub> is the actual fuel economy in the light trucks vehicle class during enforcement cycle "i" in which credits are transferred

CAFE TARGET<sub>pc, enforcement cycle "i"</sub> is the target fuel economy in the passenger cars vehicle class during enforcement cycle "i" in which credits are transferred

CAFE TARGET<sub>lt, enforcement cycle "i"</sub> is the target fuel economy in the light trucks vehicle class during enforcement cycle "i" in which credits are transferred

For the purpose of this standard, the lifetime vehicle kilometers traveled for the passenger cars vehicle class and for the light trucks vehicle class during any enforcement cycle will be considered equal.

#### **4.5.2.3.4. Participation in Data sharing program**

SASO has established a Data sharing program in order to enhance its current vehicle database.

Automotive manufacturers enrolled in the Data sharing Program are required to submit:

- a- An annual sales plan as detailed below in section 6.1.1.2
- b- A mid-year review of the aforementioned sales plan
- c- A year-end actual sales report

The Data Sharing Program is divided into two phases:

- a- Phase I will extend from January 1, 2016 until December 31, 2017.  
The deadline of enrollment in Phase I is November 16, 2014.
- b- Phase II will extend from January 1, 2018 until December 31, 2020.  
The deadline of enrollment in Phase II is November 1, 2017.  
Participants in Phase I of the Data Sharing Program will be automatically enrolled in Phase II unless they explicitly request otherwise.

#### **4.5.2.3.5. Additional flexibility mechanisms**

Automotive manufacturers who enroll in the Data Sharing Program shall be eligible to receive additional flexibility mechanisms detailed in Appendix – I below.

Starting on the third enforcement cycle and in addition to participation in the Data Sharing Program, Automotive manufacturers will be required to submit fuel economy data based on fuel economy tests conducted in a SASO or International Laboratory Accreditation Cooperation (ILAC) accredited laboratory.

### **5- DETAILED DESCRIPTION OF THE STANDARD for USED IMPORT VEHICLES**

The fuel economy standard for incoming used import vehicles in the Kingdom of Saudi Arabia is based on the minimum energy performance concept i.e.

- a. A minimum allowed fuel economy is defined in advance.
- b. If the actual fuel economy of the vehicle is strictly less than the minimum allowed fuel economy, the vehicle will be banned from entering the Kingdom of Saudi Arabia.

The technical details of the standard are explained below:

#### **5.1. The enforcement date**

The standard shall be effective as of January 1, 2016 and shall last until December 31, 2020.



## **5.2. The minimum allowed fuel economy**

Each motor vehicle class (i.e. passenger cars and light trucks) will have a different minimum allowed fuel economy,

The minimum allowed fuel economy should be adopted as of January 1, 2016 and is defined at:

- a. 10.3 km / liter for passenger cars tested as per the US EPA driving cycle.
- b. 9.0 km / liter for light trucks tested as per the US EPA driving cycle.

Shall SASO decide to update the minimum allowed fuel economy requirements on used imports, an amendment will be shared with all stakeholders, including automotive manufacturers and importers.

A minimum of six months grace period shall be provided prior to the enforcement of the amended minimum allowed fuel economy requirements.

## **5.3. Determination of the actual fuel economy of the used import vehicle**

Vehicles shall be granted an actual fuel economy value based on “SASO fuel economy database”. A copy of the database will be available with the Saudi Customs and SEEC.

If the vehicle is not available on the “SASO fuel economy database, the importer should provide the model fuel economy based on the results of the tests conducted in a SASO or International Laboratory Accreditation Cooperation (ILAC) accredited laboratory.

## **6- IMPLEMENTATION MECHANISMS**

### **6.1. Implementation mechanisms of the standard for new incoming vehicles**

#### **6.1.1. Authorization (before commencement of upcoming enforcement cycle)**

6.1.1.1 Automotive manufacturers shall submit the Model Type Approval (MTA) request to GSO for each model intended for export to the Kingdom of Saudi Arabia. The MTA shall include the fuel economy values according to the US EPA drive cycle and combined values shall be reported), or the approved equivalent drive cycle, as well as the motor vehicle class (i.e. passenger car or light truck).

6.1.1.2 Automotive manufacturers shall submit their supply plan of vehicles for each upcoming enforcement cycle to MoCI, at least three month before the commencement of the cycle, using the Saudi Arabia fuel economy software. The supply plan shall include the following information:

- 6.1.1.2.1 Auto Manufacturer Group
- 6.1.1.2.2 Vehicle Make
- 6.1.1.2.3 Model Year
- 6.1.1.2.4 Vehicle Commercial Name

- 6.1.1.2.5 Engine Displacement (cubic centimeter)
  - 6.1.1.2.6 Engine Type (Internal Combustion, Hybrid, Electric, other)
  - 6.1.1.2.7 Air Intake Technology (Regular, Super-charged, Turbo-charged, Bi-Turbo-charged, other)
  - 6.1.1.2.8 Wheelbase (millimeters)
  - 6.1.1.2.9 Front Track Width (millimeters)
  - 6.1.1.2.10 Rear Track Width (millimeters)
  - 6.1.1.2.11 Fuel Type (Gasoline 91, Gasoline 95, Diesel, Other)
  - 6.1.1.2.12 Declared Fuel Economy (kilometer per liter)<sup>3</sup>
  - 6.1.1.2.13 Curb Weight (kilograms)
  - 6.1.1.2.14 Maximum vehicle weight (kilograms)
  - 6.1.1.2.15 Motor vehicle class (i.e. passenger car or light truck)
  - 6.1.1.2.16 Transmission Type (Manual, Auto or Automated Manual Transmission, etc.)
  - 6.1.1.2.17 Transmission Gears (4, 5, 6, 7, 8, etc.)
  - 6.1.1.2.18 Engine Power (Horsepower)
  - 6.1.1.2.19 Number of cylinders (4, 6, 8, etc.)
  - 6.1.1.2.20 Drive system description (FWD, RWD, AWD etc.)
  - 6.1.1.2.21 Number of doors (4, 5, etc.)
  - 6.1.1.2.22 Seating capacity (5, 6, 7, etc.)
  - 6.1.1.2.23 List of installed air-condition efficiency technologies
  - 6.1.1.2.24 Claimed credits for each of the air-conditioning efficiency technologies
  - 6.1.1.2.25 List of installed off-cycle technologies
  - 6.1.1.2.26 Claimed credits for each of the off-cycle technologies
  - 6.1.1.2.27 Projected sales by model for the subject year
- 6.1.1.3 MoCI reserves the right to share the supply plan provided by the automotive manufacturers with the Fuel Economy Committee members for assessment and review.
- 6.1.1.4 The fleet actual fuel economy and fleet target fuel economy shall be calculated in accordance with sections 4.5.2.1. and 4.5.2.2. of this standard.
- 6.1.1.5 If the automotive manufacturer does not submit a supply plan within the allowed timeframe, the subject automotive manufacturer shall not be allowed to export vehicles to the Kingdom of Saudi Arabia until a supply plan is submitted for review and approval by MoCI (or whoever it delegates i.e. SEEC and/or the Fuel Economy Committee members). The subject automotive manufacturer shall be responsible for any delays occurring in its commercial activities inside the Kingdom of Saudi Arabia.

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<sup>3</sup> If a given vehicle has been included in the supply plan of the automotive manufacturer but has not been tested for fuel economy, the automotive manufacturer should report the estimated fuel economy for the vehicle and indicate that the fuel economy entry is based on internal estimates. The fuel economy entries based on internal estimates shall be revised by July of the enforcement cycle to reflect tested fuel economy value of the vehicle.

6.1.1.6 If the submitted supply plan shows that the automotive manufacturer does not comply with the standard requirements (compliance shall be determined as described in section 4.5.2.3. of this standard), the subject automotive manufacturer shall not be allowed to export vehicles to the Kingdom of Saudi Arabia until an alternative supply plan (ensuring compliance) is resubmitted for review and approval by MoCI (or whoever it delegates i.e. SEEC and/or the Fuel Economy Committee). The subject automotive manufacturer shall be responsible for any delays occurring in its commercial activities inside the Kingdom of Saudi Arabia.

6.1.1.7 If the automotive manufacturer does not comply with the standard during a previous enforcement cycle (compliance shall be determined as described in section 4.5.2.3. of this standard), the subject automotive manufacturer shall not be allowed to export vehicles to the Kingdom of Saudi Arabia until an alternative supply plan shall be resubmitted for review and approval by MoCI (or whoever it delegates i.e. SEEC and/or the Fuel Economy Committee members) no later than two months from the notification received from MoCI or whoever it delegates. This alternative supply plan should generate enough credits to offset all of the accumulated deficits from the previous enforcement cycle. The subject automotive manufacturer shall be responsible for any delays occurring in its commercial activities inside the Kingdom of Saudi Arabia.

6.1.1.8 The automotive manufacturer shall provide a Model Type Approval for each shipment of the same vehicle model, from an authorized inspection entity, prior to exporting the vehicles to the Kingdom of Saudi Arabia.

### **6.1.2. At the border (during ongoing enforcement cycle)**

6.1.2.1 MoCI, or whoever it delegates, reserves the right to request each importer to present the Model Type Approval for each shipment of vehicles.

6.1.2.2 MoCI, or whoever it delegates, reserves the right to sample any vehicle and send it for a local laboratory of its choice for fuel economy testing to ensure compliance with the value provided in the supply plan. The importer shall be responsible for vehicle delivery to the testing facility and the expenses of the test.

6.1.2.3 MoCI, or whoever it delegates, reserves the right to hold any vehicle shipments at the port of entry or any other location of its selection until the automotive manufacturer submits a supply plan that ensures compliance of with this standard.

6.1.2.4 MoCI, or whoever it delegates, shall keep the automotive manufacturers informed on their fuel economy performance on a semi-annual basis.

### **6.1.3. Standard enforcement (at end of ongoing enforcement cycle)**

6.1.3.1 At the end of the ongoing enforcement cycle, SEEC will assess the compliance of each automotive manufacturer in accordance with section 4.5.2.3. of this standard and using the Saudi Arabia fuel economy software, where:

6.1.3.1.1 Automotive manufacturers complying with the standard may resume their operations in the Kingdom of Saudi Arabia normally.

6.1.3.1.2 Automotive manufacturers not complying with the standard shall submit a supply plan that ensures compliance with the standard i.e. the subject automotive manufacturer should submit a plan that generates, in the next enforcement cycle, enough credits to offset the deficit generated from the past enforcement cycle, as mentioned in section 6.1.1.7.

6.1.3.2 Automotive manufacturers will be informed of their fuel economy performance no later than six months after the conclusion of the ongoing enforcement cycle.

6.1.3.3 Automotive manufacturers which are not compliant with the standard (compliance shall be determined as described in section 4.5.2.3. of this standard) shall be required to achieve the target on each model rather than on a fleet average starting with the next upcoming enforcement cycle and for at least one enforcement cycle, where the minimum allowed fuel economy for each model will be determined using the target curves of the next upcoming enforcement cycle as detailed in section 4.4 (i.e. within each motor vehicle class, each footprint is assigned a minimum allowed fuel economy target).

6.1.3.4 This requirement shall continue until the automotive manufacturer accumulated enough credits to offset the deficits due.

#### **6.1.4. Petitions and dispute resolution**

6.1.4.1 Automotive manufacturers have the right to petition the compliance results shared by MoCI. Petitions shall be submitted to the Fuel Economy Committee.

6.1.4.2 The automotive manufacturer will be required to submit a comprehensive report stating the purpose of the petition and all necessary supporting data and reports.

6.1.4.3 Disputes that are not resolved through reconciliation may be directed, either by the Fuel Economy Committee or by the automotive manufacturer, to the judicial authorities of the Kingdom of Saudi Arabia.

6.1.4.4 For an automotive manufacturer filing a petition, the requirements of sections 6.1.1, 6.1.2 and 6.1.3. shall remain effective until a decision emerges from the Fuel Economy Committee or the judicial authorities.

### **6.2. Implementation mechanism of the standard for used import vehicles**

#### **6.2.1. Pre-border (before commencement of upcoming enforcement cycle)**

6.2.1.1 The importer shall be responsible to provide the actual fuel economy of the used import vehicle (as described in section 5.3).

6.2.1.2 For a used import vehicle to be allowed to enter the Kingdom of Saudi Arabia, the actual fuel economy shall be equal or greater than the minimum allowed fuel economy (as described in section 5.2)

#### **6.2.2. At the border (during ongoing enforcement cycle)**

6.2.2.1 Saudi Arabia Customs shall compare the reported actual fuel economy of each used import vehicle (as determined in accordance with section 5.3) with the minimum allowed fuel economy (as determined in accordance with section 5.2).

6.2.2.1.1 If the actual fuel economy of the used import vehicle is greater than or equal to the minimum allowed fuel economy, then the vehicle shall be granted custom clearance (assuming that all other requirements are satisfied i.e. safety requirements, emissions requirements, etc.)

6.2.2.1.2 If the actual fuel economy of the used vehicle is strictly less than the minimum allowed fuel economy of the same vehicle, then the vehicle shall not be granted custom clearance independently of whether it satisfies other requirements or not.

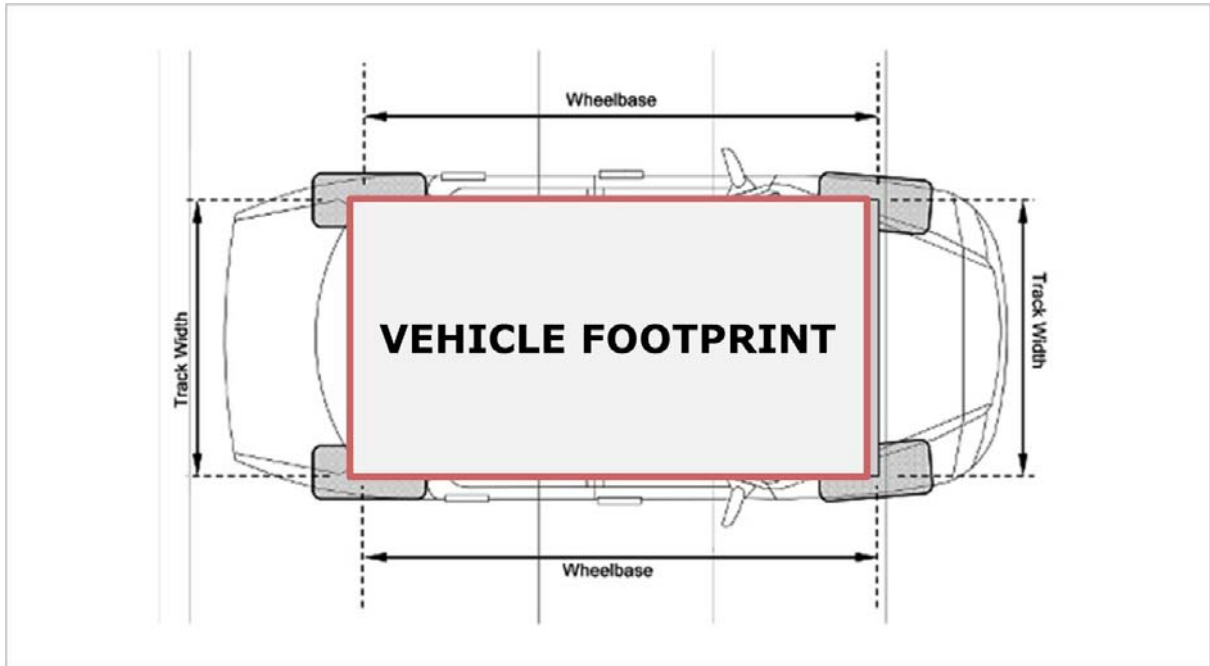
6.2.2.2 MoCI, or whoever it delegates, reserves the right to sample any vehicle and send it for a local laboratory of its choice for fuel economy testing to ensure compliance with declared fuel economy. The importer shall be responsible for vehicle delivery to the testing facility and the expenses of the test.

### **7- REVIEW OF THE STANDARD**

A thorough review of the standard shall be completed and shared with all stakeholders, including automotive manufacturers and importers, before December 31, 2018. The review shall yield the fuel economy targets for the period extending from 2021 until 2025, addition or removal of flexibility mechanisms and the potential changes to enforcement and implementation mechanism

Figure – I

**Vehicle footprint definition**



**Table – I**  
**Conversion table for NEDC based fuel economy test reports**

<b>NEDC (km/liter)</b>	<b>CAFE (km/liter)</b>	<b>NEDC (km/liter)</b>	<b>CAFE (km/liter)</b>	<b>NEDC (km/liter)</b>	<b>CAFE (km/liter)</b>
<b>3.0</b>	3.8	<b>7.1</b>	8.3	<b>11.2</b>	12.6
<b>3.1</b>	3.9	<b>7.2</b>	8.4	<b>11.3</b>	12.7
<b>3.2</b>	4.1	<b>7.3</b>	8.5	<b>11.4</b>	12.8
<b>3.3</b>	4.2	<b>7.4</b>	8.6	<b>11.5</b>	12.9
<b>3.4</b>	4.3	<b>7.5</b>	8.7	<b>11.6</b>	13.0
<b>3.5</b>	4.4	<b>7.6</b>	8.8	<b>11.7</b>	13.1
<b>3.6</b>	4.5	<b>7.7</b>	8.9	<b>11.8</b>	13.2
<b>3.7</b>	4.6	<b>7.8</b>	9.1	<b>11.9</b>	13.3
<b>3.8</b>	4.7	<b>7.9</b>	9.2	<b>12.0</b>	13.4
<b>3.9</b>	4.8	<b>8.0</b>	9.3	<b>12.1</b>	13.5
<b>4.0</b>	5.0	<b>8.1</b>	9.4	<b>12.2</b>	13.6
<b>4.1</b>	5.1	<b>8.2</b>	9.5	<b>12.3</b>	13.7
<b>4.2</b>	5.2	<b>8.3</b>	9.6	<b>12.4</b>	13.8
<b>4.3</b>	5.3	<b>8.4</b>	9.7	<b>12.5</b>	13.9
<b>4.4</b>	5.4	<b>8.5</b>	9.8	<b>12.6</b>	14.0
<b>4.5</b>	5.5	<b>8.6</b>	9.9	<b>12.7</b>	14.1
<b>4.6</b>	5.6	<b>8.7</b>	10.0	<b>12.8</b>	14.2
<b>4.7</b>	5.7	<b>8.8</b>	10.1	<b>12.9</b>	14.3
<b>4.8</b>	5.8	<b>8.9</b>	10.2	<b>13.0</b>	14.4
<b>4.9</b>	5.9	<b>9.0</b>	10.3	<b>13.1</b>	14.5
<b>5.0</b>	6.1	<b>9.1</b>	10.4	<b>13.2</b>	14.6
<b>5.1</b>	6.2	<b>9.2</b>	10.5	<b>13.3</b>	14.7
<b>5.2</b>	6.3	<b>9.3</b>	10.6	<b>13.4</b>	14.8
<b>5.3</b>	6.4	<b>9.4</b>	10.7	<b>13.5</b>	14.9
<b>5.4</b>	6.5	<b>9.5</b>	10.8	<b>13.6</b>	15.0
<b>5.5</b>	6.6	<b>9.6</b>	10.9	<b>13.7</b>	15.1
<b>5.6</b>	6.7	<b>9.7</b>	11.0	<b>13.8</b>	15.2
<b>5.7</b>	6.8	<b>9.8</b>	11.1	<b>13.9</b>	15.3
<b>5.8</b>	6.9	<b>9.9</b>	11.2	<b>14.0</b>	15.4
<b>5.9</b>	7.0	<b>10.0</b>	11.3	<b>14.1</b>	15.5
<b>6.0</b>	7.1	<b>10.1</b>	11.4	<b>14.2</b>	15.6
<b>6.1</b>	7.2	<b>10.2</b>	11.5	<b>14.3</b>	15.7
<b>6.2</b>	7.4	<b>10.3</b>	11.6	<b>14.4</b>	15.8
<b>6.3</b>	7.5	<b>10.4</b>	11.7	<b>14.5</b>	15.9
<b>6.4</b>	7.6	<b>10.5</b>	11.9	<b>14.6</b>	16.0
<b>6.5</b>	7.7	<b>10.6</b>	12.0	<b>14.7</b>	16.1
<b>6.6</b>	7.8	<b>10.7</b>	12.1	<b>14.8</b>	16.2
<b>6.7</b>	7.9	<b>10.8</b>	12.2	<b>14.9</b>	16.3
<b>6.8</b>	8.0	<b>10.9</b>	12.3	<b>15.0</b>	16.4
<b>6.9</b>	8.1	<b>11.0</b>	12.4	<b>15.1</b>	16.5
<b>7.0</b>	8.2	<b>11.1</b>	12.5	<b>15.2</b>	16.6

<b>NEDC (km/liter)</b>	<b>CAFE (km/liter)</b>	<b>NEDC (km/liter)</b>	<b>CAFE (km/liter)</b>	<b>NEDC (km/liter)</b>	<b>CAFE (km/liter)</b>
<b>15.3</b>	16.7	<b>19.4</b>	20.7	<b>23.5</b>	24.7
<b>15.4</b>	16.8	<b>19.5</b>	20.8	<b>23.6</b>	24.8
<b>15.5</b>	16.9	<b>19.6</b>	20.9	<b>23.7</b>	24.9
<b>15.6</b>	17.0	<b>19.7</b>	21.0	<b>23.8</b>	25.0
<b>15.7</b>	17.1	<b>19.8</b>	21.1	<b>23.9</b>	25.1
<b>15.8</b>	17.2	<b>19.9</b>	21.2	<b>24.0</b>	25.2
<b>15.9</b>	17.3	<b>20.0</b>	21.3	<b>24.1</b>	25.3
<b>16.0</b>	17.4	<b>20.1</b>	21.4	<b>24.2</b>	25.4
<b>16.1</b>	17.5	<b>20.2</b>	21.5	<b>24.3</b>	25.5
<b>16.2</b>	17.6	<b>20.3</b>	21.6	<b>24.4</b>	25.6
<b>16.3</b>	17.7	<b>20.4</b>	21.7	<b>24.5</b>	25.7
<b>16.4</b>	17.8	<b>20.5</b>	21.8	<b>24.6</b>	25.7
<b>16.5</b>	17.9	<b>20.6</b>	21.9	<b>24.7</b>	25.8
<b>16.6</b>	18.0	<b>20.7</b>	22.0	<b>24.8</b>	25.9
<b>16.7</b>	18.1	<b>20.8</b>	22.1	<b>24.9</b>	26.0
<b>16.8</b>	18.2	<b>20.9</b>	22.2	<b>25.0</b>	26.1
<b>16.9</b>	18.3	<b>21.0</b>	22.3	<b>25.1</b>	26.2
<b>17.0</b>	18.4	<b>21.1</b>	22.4	<b>25.2</b>	26.3
<b>17.1</b>	18.5	<b>21.2</b>	22.5	<b>25.3</b>	26.4
<b>17.2</b>	18.6	<b>21.3</b>	22.6	<b>25.4</b>	26.5
<b>17.3</b>	18.7	<b>21.4</b>	22.7	<b>25.5</b>	26.6
<b>17.4</b>	18.8	<b>21.5</b>	22.8	<b>25.6</b>	26.7
<b>17.5</b>	18.9	<b>21.6</b>	22.9	<b>25.7</b>	26.8
<b>17.6</b>	19.0	<b>21.7</b>	23.0	<b>25.8</b>	26.9
<b>17.7</b>	19.1	<b>21.8</b>	23.1	<b>25.9</b>	27.0
<b>17.8</b>	19.2	<b>21.9</b>	23.2	<b>26.0</b>	27.1
<b>17.9</b>	19.3	<b>22.0</b>	23.2	<b>26.1</b>	27.2
<b>18.0</b>	19.4	<b>22.1</b>	23.3	<b>26.2</b>	27.3
<b>18.1</b>	19.5	<b>22.2</b>	23.4	<b>26.3</b>	27.4
<b>18.2</b>	19.6	<b>22.3</b>	23.5	<b>26.4</b>	27.5
<b>18.3</b>	19.7	<b>22.4</b>	23.6	<b>26.5</b>	27.6
<b>18.4</b>	19.7	<b>22.5</b>	23.7	<b>26.6</b>	27.7
<b>18.5</b>	19.8	<b>22.6</b>	23.8	<b>26.7</b>	27.8
<b>18.6</b>	19.9	<b>22.7</b>	23.9	<b>26.8</b>	27.8
<b>18.7</b>	20.0	<b>22.8</b>	24.0	<b>26.9</b>	27.9
<b>18.8</b>	20.1	<b>22.9</b>	24.1	<b>27.0</b>	28.0
<b>18.9</b>	20.2	<b>23.0</b>	24.2	<b>27.1</b>	28.1
<b>19.0</b>	20.3	<b>23.1</b>	24.3	<b>27.2</b>	28.2
<b>19.1</b>	20.4	<b>23.2</b>	24.4	<b>27.3</b>	28.3
<b>19.2</b>	20.5	<b>23.3</b>	24.5	<b>27.4</b>	28.4



<b>19.3</b>	20.6	<b>23.4</b>	24.6	<b>27.5</b>	28.5
<b>NEDC (km/liter)</b>	CAFE (km/liter)	<b>NEDC (km/liter)</b>	CAFE (km/liter)	<b>NEDC (km/liter)</b>	CAFE (km/liter)
<b>27.6</b>	28.6	<b>31.8</b>	32.6	<b>36.0</b>	36.5
<b>27.7</b>	28.7	<b>31.9</b>	32.7	<b>36.1</b>	36.6
<b>27.8</b>	28.8	<b>32.0</b>	32.8	<b>36.2</b>	36.7
<b>27.9</b>	28.9	<b>32.1</b>	32.9	<b>36.3</b>	36.8
<b>28.0</b>	29.0	<b>32.2</b>	32.9	<b>36.4</b>	36.9
<b>28.1</b>	29.1	<b>32.3</b>	33.0	<b>36.5</b>	37.0
<b>28.2</b>	29.2	<b>32.4</b>	33.1	<b>36.6</b>	37.1
<b>28.3</b>	29.3	<b>32.5</b>	33.2	<b>36.7</b>	37.1
<b>28.4</b>	29.4	<b>32.6</b>	33.3	<b>36.8</b>	37.2
<b>28.5</b>	29.5	<b>32.7</b>	33.4	<b>36.9</b>	37.3
<b>28.6</b>	29.6	<b>32.8</b>	33.5	<b>37.0</b>	37.4
<b>28.7</b>	29.7	<b>32.9</b>	33.6	<b>37.1</b>	37.5
<b>28.8</b>	29.7	<b>33.0</b>	33.7	<b>37.2</b>	37.6
<b>28.9</b>	29.8	<b>33.1</b>	33.8	<b>37.3</b>	37.7
<b>29.0</b>	29.9	<b>33.2</b>	33.9	<b>37.4</b>	37.8
<b>29.1</b>	30.0	<b>33.3</b>	34.0	<b>37.5</b>	37.9
<b>29.2</b>	30.1	<b>33.4</b>	34.1	<b>37.6</b>	38.0
<b>29.3</b>	30.2	<b>33.5</b>	34.2	<b>37.7</b>	38.1
<b>29.4</b>	30.3	<b>33.6</b>	34.3	<b>37.8</b>	38.2
<b>29.5</b>	30.4	<b>33.7</b>	34.4	<b>37.9</b>	38.3
<b>29.6</b>	30.5	<b>33.8</b>	34.4	<b>38.0</b>	38.4
<b>29.7</b>	30.6	<b>33.9</b>	34.5	<b>38.1</b>	38.4
<b>29.8</b>	30.7	<b>34.0</b>	34.6	<b>38.2</b>	38.5
<b>29.9</b>	30.8	<b>34.1</b>	34.7	<b>38.3</b>	38.6
<b>30.0</b>	30.9	<b>34.2</b>	34.8	<b>38.4</b>	38.7
<b>30.1</b>	31.0	<b>34.3</b>	34.9	<b>38.5</b>	38.8
<b>30.2</b>	31.1	<b>34.4</b>	35.0	<b>38.6</b>	38.9
<b>30.3</b>	31.2	<b>34.5</b>	35.1	<b>38.7</b>	39.0
<b>30.4</b>	31.3	<b>34.6</b>	35.2	<b>38.8</b>	39.1
<b>30.5</b>	31.3	<b>34.7</b>	35.3	<b>38.9</b>	39.2
<b>30.6</b>	31.4	<b>34.8</b>	35.4	<b>39.0</b>	39.3
<b>30.7</b>	31.5	<b>34.9</b>	35.5	<b>39.1</b>	39.4
<b>30.8</b>	31.6	<b>35.0</b>	35.6	<b>39.2</b>	39.5
<b>30.9</b>	31.7	<b>35.1</b>	35.7	<b>39.3</b>	39.6
<b>31.0</b>	31.8	<b>35.2</b>	35.8	<b>39.4</b>	39.6
<b>31.1</b>	31.9	<b>35.3</b>	35.8	<b>39.5</b>	39.7
<b>31.2</b>	32.0	<b>35.4</b>	35.9	<b>39.6</b>	39.8
<b>31.3</b>	32.1	<b>35.5</b>	36.0	<b>39.7</b>	39.9
<b>31.4</b>	32.2	<b>35.6</b>	36.1	<b>39.8</b>	40.0
<b>31.5</b>	32.3	<b>35.7</b>	36.2	<b>39.9</b>	40.1

<b>31.6</b>	32.4	<b>35.8</b>	36.3	<b>40.0</b>	40.2
<b>31.7</b>	32.5	<b>35.9</b>	36.4		

## Appendix – I

### **Additional flexibility mechanisms**

In addition to the flexibility mechanisms described in section 4.5.2.3.3, the automotive manufacturers participating in the Data Sharing Program as detailed in section 4.5.2.3.4 will be eligible to receive the additional flexibilities detailed below:

#### **Phase-in mechanism**

Automotive manufacturers may elect to apply a phase-in mechanism on their passenger car and light truck fleet sales.

Should the automotive manufacturer elect to apply the aforementioned phase-in mechanism, it would be applied on both motor vehicle classes.

For the purposes of determining each manufacturer's average fuel economy for each of the two motor vehicle classes, the following percentages of the manufacturer's most efficient passenger cars and light trucks sales in the relevant enforcement cycle shall be taken into account.

Jan 1, 2016 – Dec 31, 2016	Jan 1, 2017 – Dec 31, 2017	Jan 1, 2018 – Dec 31, 2018	Jan 1, 2019 – Dec 31, 2019	Jan 1, 2020– Dec 31, 2020
80%	90%	100%	100%	100%

The most efficient vehicles are defined as the vehicles that have the highest differential between the model's actual fuel economy and the model's target fuel economy (i.e. Actual fuel economy - Target fuel economy).

#### **Extended credit carry backwards**

Automotive manufacturers, eligible to receive the additional flexibilities, will be allowed to carry back deficits generated in any given enforcement cycle, for three subsequent enforcement cycles.

In case of non-compliance in enforcement cycle "i", the automotive manufacturer will then be allowed a period of three enforcement cycles to offset the accumulated deficit.

In case not enough credits are accumulated in the three enforcement cycles subsequent to enforcement cycle "i" to offset all deficits generated (i.e. the automotive manufacturer still carries deficits in enforcement cycle "i+4"), the enforcement mechanism detailed in section 6.1.3.3 will be applied on the non-compliant automotive manufacturer.

An automotive manufacturer may not carry both credits and deficits simultaneously at any given enforcement cycle.

### **Off-cycle technology credits**

Starting on the third enforcement cycle of the standard (Jan 1, 2018 – Dec 31, 2018) onwards, automotive manufacturers, eligible to receive the additional flexibilities, will be allowed to generate credits, for the use, in their fleet of passenger cars or light trucks, of technologies designed to reduce real-world fuel consumption which cannot be completely measured using the testing approach specified in Section 4.5.2.1 of this standard. These credits are referred to as “off-cycle technology credits”.

- a- Automotive manufacturers may generate off-cycle technology CO2 credits (grams CO2/mile) for certain technologies in agreement with U.S Code of Federal Regulations Title 40 CFR 86.1869 – 12 (b)(1)
- b- For technologies not covered in provision a above and verifiable by the 5-cycle testing methodology, automotive manufacturers may generate off-cycle technology CO2 credits (grams CO2/mile) in agreement with U.S Code of Federal Regulations Title 40 CFR 86.1869 – 12 (c)
- c- For technologies not covered in provision a above and not verifiable by the 5-cycle testing methodology, automotive manufacturers may generate off-cycle technology CO2 credits (grams CO2/mile) in agreement with U.S Code of Federal Regulations Title 40 CFR 86.1869 – 12 (d)(1)

The calculated off-cycle technology CO2 credits in grams CO2/mile for each technology shall be converted to liters/kilometer in accordance with the following equation:

$$\text{Off-cycle technology fuel consumption improvement per technology } \left( \frac{\text{l}}{\text{km}} \right) = \frac{\text{Off-cycle technology CO2 credits per technology } \left( \frac{\text{gCO2}}{\text{mi}} \right)}{1.609344 \times \text{CO2 content factor } \left( \frac{\text{gCO2}}{\text{l}} \right)}$$

Where CO2 content factor is determined as per the below table:

Fuel type	CO2 content factor (grams CO2/liter)
Petrol	2337
Diesel	2684

The actual fuel economy of all vehicles equipped with the off-cycle technologies will be directly adjusted to incorporate the impact of the installed technologies. The off-cycle efficiency credits shall be capped at 0.00266 l/km per year on a combined passenger car and light truck fleet average. The cap would not apply on a vehicle model basis, allowing automotive manufacturers the flexibility to focus off-cycle technologies on certain vehicle models and generate improvements for that vehicle model in excess of 0.00266 l/km.

Manufacturers seeking off-cycle credits must submit an application for off-cycle credits determined under provisions b and c of this section. As per U.S Code of Federal Regulations Title 40 CFR 86.1869 – 12 (e)(2), the application must contain the following:

- 1- A detailed description of the off-cycle technology and how it functions to reduce CO2 emissions under conditions not represented on the FTP and HFET.
- 2- A list of the vehicle model(s) which will be equipped with the technology.
- 3- A detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing.
- 4- All testing and/or simulation data required under provision b or c of this section, as applicable, plus any other data the manufacturer has considered in the analysis.
- 5- For credits under provision c of this section, a complete description of the methodology used to estimate the off-cycle benefit of the technology and all supporting data, including vehicle testing and in-use activity data.
- 6- An estimate of the off-cycle benefit by vehicle model and the fleet-wide benefit based on projected sales of vehicle models equipped with the technology.
- 7- An engineering analysis and/or component durability testing data or whole vehicle testing data demonstrating the in-use durability of the off-cycle technology components.

SASO, or whomever it delegates, will review the automotive manufacturer request and approve/decline accordingly.

#### **Air-conditioning efficiency credits**

Starting on the third enforcement cycle of the standard (Jan 1, 2018 – Dec 31, 2018) onwards, automotive manufacturers, eligible to receive the additional flexibilities, will be allowed to generate credits for the use, in their fleet of passenger cars or light trucks, of air conditioning systems that incorporate technologies designed to reduce air-conditioning-related fuel consumption by improving the air conditioning system efficiency of those fleets. The menu of technologies which an automotive manufacturer may utilize to generate Air-Conditioning efficiency credits along with the maximum credit limit for each technology is illustrated in the table below:

Technology description	Passenger car A/C efficiency fuel consumption improvement (liter/km)	Light truck A/C efficiency fuel consumption improvement (liter/km)
Reduced reheat, with externally-controlled, variable-displacement compressor	0.000779	0.001143
Reduced reheat, with externally-controlled, fixed-displacement or pneumatic variable displacement compressor	0.000521	0.000728
Default to recirculated air with closed-loop control of the air supply (sensor feedback to control interior air quality) whenever the outside ambient temperature is 75 °F or higher (although deviations from this temperature are allowed based on additional analysis)	0.000779	0.001143
Default to recirculated air with open-loop control of the air supply (no sensor feedback) whenever the outside ambient temperature is 75 °F or higher (although deviations from this temperature are allowed if accompanied by an engineering analysis)	0.000521	0.000728
Blower motor controls that limit wasted electrical energy (e.g. pulse width modulated power controller)	0.000415	0.000572
Internal heat exchanger (or suction line heat exchanger)	0.000521	0.000728
Improved evaporators and condensers (with engineering analysis on each component indicating a COP improvement greater than 10%, when compared to previous design)	0.000521	0.000728
Oil Separator (internal or external to compressor)	0.000258	0.000364

Air-Conditioning efficiency shall be tested in accordance to the Environmental Protection Agency AC17 test procedure.

In order to receive the full amount of Air-Conditioning efficiency credits, the difference between the new and baseline results should be equal to or greater than the sum of the menu-based credits for technologies present on the new vehicle; where:

- In cases where the difference between the new and baseline results are greater than 0 but less than the sum of the menu-based credits, manufacturers can:
  - Submit an engineering analysis that justifies the generation of the full amount of A/C efficiency credits, or
  - Receive partial credits (proportionally to the ratio of the difference of the AC17 test results and the sum of the new technology menu credits)

- In cases where no baseline comparison test results is available (e.g. brand-new platform has been created), manufacturers will be required to submit an engineering analysis that justifies the generation of the full amount of Air-Conditioning efficiency credits

The actual fuel economy of all vehicles equipped with the Air-Conditioning efficiency will be directly adjusted to incorporate the impact of the installed technologies.

The air-conditioning efficiency credits shall be capped at 0.0026 l/km and 0.0037 l/km for passenger cars and light trucks accordingly

SASO, or whomever it delegates, will review the automotive manufacturer request and approve/decline accordingly.

#### **Exemption of emergency and law-enforcement vehicles**

Automotive manufacturers, eligible to receive the additional flexibilities, may apply for an exemption for vehicles sold for emergency and law-enforcement purposes from the here-mentioned corporate average standard.

The follow are general guideline for emergency and law-enforcement vehicles:

- (i) Emergency vehicles refer mostly to ambulances and civil defense vehicles
- (ii) Law enforcement vehicles refer mostly to vehicles used by law enforcement agencies for the purpose of enforcing regulations in the country; e.g. Police, Traffic Police, Highway Patrol, Military, etc. Law enforcement vehicles exemption does not pertain to vehicles used by government agencies for non-law enforcement purposes

Automotive manufacturers wishing to benefit from this flexibility shall submit a copy of the official contract with the specific Government agency in the Kingdom listing all the vehicles along with their technical specifications as illustrated in sections 6.1.1.2.1-6, 6.1.1.2.11 and 6.1.1.2.15-17

SASO, or whomever it delegates, will review the automotive manufacturer application and approve/decline accordingly.

#### **Credit transfer between automotive manufacturers**

Automotive manufacturers would be allowed to transfer credits to other automotive manufacturers provided that both parties are eligible to receive the additional flexibilities.

An automotive manufacturer can only start transferring credits to other manufacturers after offsetting any deficits it may have.

An automotive manufacturer cannot transfer more credits than available in their Credit Balance.

In order to ensure that the fuel savings are preserved, an adjustment factor needs to be applied to the credits when transferred from one manufacturer to another.

The transfer adjustment factor is determined as per the below formula:

$$\frac{VKT_{e, v \text{ class } e, \text{ enforcement cycle } "i"} * CAFE_{ACTUAL_{u, v \text{ class } u, \text{ enforcement cycle } "j"}} * CAFE_{TARGET_{u, v \text{ class } u, \text{ enforcement cycle } "j"}}}{VKT_{u, v \text{ class } u, \text{ enforcement cycle } "j"} * CAFE_{ACTUAL_{e, v \text{ class } e, \text{ enforcement cycle } "i"}} * CAFE_{TARGET_{e, v \text{ class } e, \text{ enforcement cycle } "i"}}$$

Where,

VKT<sub>e, v class e, enforcement cycle "i"</sub> is the lifetime vehicle kilometers traveled of the originating automotive manufacturer (earner) in the specific vehicle class and during enforcement cycle "i" in which the credit was earned

CAFE ACTUAL<sub>u, v class u, enforcement cycle "j"</sub> is the actual fuel economy of the receiving automotive manufacturer (user) in the specific vehicle class and during enforcement cycle "j" in which the credit is used for compliance

CAFE TARGET<sub>u, v class u, enforcement cycle "j"</sub> is the target fuel economy of the receiving automotive manufacturer (user) in the specific vehicle class and during enforcement cycle "j" in which the credit is used for compliance

VKT<sub>u, v class u, enforcement cycle "j"</sub> is the lifetime vehicle kilometers traveled of the receiving automotive manufacturer (user) in the specific vehicle class and during enforcement cycle "j" in which the credit is used for compliance

CAFE ACTUAL<sub>e, v class e, enforcement cycle "i"</sub> is the actual fuel economy of the originating automotive manufacturer (earner) in the specific vehicle class and during enforcement cycle "i" in which the credit was earned

CAFE TARGET<sub>e, v class e, enforcement cycle "i"</sub> is the target fuel economy of the originating automotive manufacturer (earner) in the specific vehicle class and during enforcement cycle "i" in which the credit was earned

For the purpose of this standard, the lifetime vehicle kilometers traveled for the passenger cars vehicle class and for the light trucks vehicle class during any enforcement cycle will be considered equal.

### **Derogation from standard requirements for independent small-volume manufacturers**

Automotive manufacturers, eligible to receive the additional flexibilities, can apply for a derogation from standard requirements, provided that their global sales do not exceed 10,000 vehicles per year. This rule applies to independent automotive manufacturers (that are not affiliated with other automotive manufacturers) or automotive manufacturers affiliated to a Parent Group, provided they are able to demonstrate operational independence from their respective Parent Group.



For an automotive manufacturer to demonstrate operational independence from their Parent Group, they need to operate their own research, design, production, and manufacturing facilities independently from the Parent Group.

For any eligible automotive manufacturer to be granted the derogation from standard requirements during a specific enforcement cycle, they need to submit a detailed improvement plan to SASO.

The detailed improvement plan should include:

- (i) A supply plan in accordance with section 6.1.1.2.
- (ii) Projected level of fuel economy improvements for each model for the next three years

SASO, or whomever it delegates, will review the automotive manufacturer application and approve/decline accordingly.

**REFERENCES**

- U.S Code of Federal Regulations Title 40 CFR 86.1869 – 12