

China's Stage 4 fuel consumption standard for light commercial vehicles

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On August 23, 2024, China's Ministry of Industry and Information Technology published the Stage 4 fuel consumption (L/100 km) standard for light commercial vehicles (LCVs).¹ The regulation updates the Stage 3 fuel consumption standard on a per-vehicle basis and introduces a corporate average fuel consumption (CAFC) standard; it covers buses and trucks with a maximum gross vehicle weight of no more than 3,500 kg and takes effect on January 1, 2026.² Special purpose vehicles, which include sanitation vehicles, armored vehicles, fire trucks, and rescue vehicles, are excluded from the standard.

BACKGROUND

Improving the fuel economy of LCVs is a pivotal part of realizing China's goals to peak carbon dioxide (CO₂) emissions by 2030 and achieve carbon neutrality by 2060.³ From 2021 to 2023, China sold an average of 1.4 million LCVs per year, and more than 95% of these were trucks.⁴

The previous three stages of China's per-vehicle fuel consumption standards for gasoline and diesel LCVs are detailed in Figure 1. The Stage 2 standards, fully implemented in 2011, increased the stringency level by 5%–10% compared with Stage 1. Stage 3, which took full effect in 2020, increased the stringency by 18%–23% compared with the Stage 2 standards.

- 1 Ministry of Industry and Information Technology of China, 轻型商用车燃料消耗量限值及评价指标 [Limits and evaluation targets of fuel consumption for light-duty commercial vehicles], 2024, <https://std.samr.gov.cn/gb/search/gbDetailed?id=208DEC46F6B147EEE06397BE0A0AA4A0>.
- 2 Trucks are defined here as cargo vehicles with a maximum designed speed of at least 50 km/h. Buses are defined as passenger vehicles with more than nine seats, including the driver's seat.
- 3 State Council of China, "China Maps Path to Carbon Peak, Neutrality Under New Development Philosophy," press release, October 24, 2021, https://english.www.gov.cn/policies/latestreleases/202110/24/content_WS61755fe9c6d0df57f98e3bed.html.
- 4 Sales data on vehicles produced domestically in China come from the vehicle information drivers provide when purchasing insurance. Insurance data for 2023 are from Gasgoo, accessed March 15, 2024, <https://autonews.gasgoo.com>; insurance data for 2022 and 2021 are from ZEDATA, accessed April 2, 2023, <http://www.zedata.cn/#/indexPage>.

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Figure 1

Timeline of China's fuel consumption standards for light commercial vehicles



*New energy vehicles include: battery electric vehicles, fuel-cell electric vehicles, and plug-in hybrid electric vehicles.

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STAGE 4 HIGHLIGHTS

- » Adopts the Worldwide harmonized Light vehicles Test Cycle (WLTC) to replace the New European Driving Cycle (NEDC)
- » Expands scope to include battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), fuel-cell electric vehicles (FCEVs), and vehicles powered by gaseous fuels and alcohol ethers
- » Updates vehicle classes by adopting a weight-based linear regression for determining fuel consumption limits instead of the prior weight-class basis and switches the reference weight from curb mass to test mass
- » Tightens the per-vehicle limits by roughly 10% compared with Stage 3
- » Introduces a CAFC requirement that phases in from 2026 to 2030
- » Introduces compliance flexibilities such as off-cycle credits and electric vehicle multipliers
- » Continues to require reporting of CO₂ emissions; sets reference factors for the conversion of fuel consumption to CO₂ emissions at 2,600 g CO₂/L for diesel vehicles and 2,370 g CO₂/L for gasoline vehicles
- » Per-vehicle limit takes effect on January 1, 2026, for new type-approvals and on February 1, 2028, for all new vehicles; the CAFC management mechanism starts January 1, 2026

TEST CYCLE

China switched the test cycle for its light-duty vehicle emission standard from the NEDC to the WLTC in 2020. The fuel consumption standard for passenger cars made the same switch in 2021.⁵ Aligning with those changes, the Stage 4 fuel consumption standard for LCVs also switched its test cycle from the NEDC to the WLTC. WLTC is more representative of real-world driving as it has a wider range of driving conditions (low, medium, high, and extra high), longer testing distances, and more realistic ambient temperature range. The European Union switched from the NEDC to the WLTC for passenger cars in 2017 and light commercial vehicles in 2018.

REGULATORY SCOPE

The previous LCV fuel consumption standards only regulated gasoline and diesel vehicles. The scope of Stage 4 is expanded to include vehicles powered by gaseous fuels, such as natural gas, alcohol ethers, and new energy vehicles (NEVs), which includes BEVs, PHEVs, and FCEVs. Under the standard, the fuel consumption of BEVs and FCEVs is zero, and the pure electric driving mode of PHEVs is also zero. For vehicles powered by gaseous fuels and alcohol ethers, their fuel consumption needs to be converted into gasoline- or diesel-equivalent values for compliance certification, according to separate standards.⁶

PER-VEHICLE LIMITS

In Stage 4, the per-vehicle fuel consumption limits are based on linear regression rather than weight class (Table 1). They range from 6.09 L/100 km to 12.32 L/100 km for gasoline trucks and from 5.19 L/100 km to 10.13 L/100 km for diesel trucks. For buses, the limits range from 5.85 L/100 km to 12.25 L/100 km for gasoline fuels, and from 5.03 L/100 km to 9.82 L/100 km for diesel fuels. For vehicles with a dump truck structure/configuration, the per-vehicle limit is 5% higher than the applicable limit for trucks.

The switch from weight-class-based fuel consumption limits in Stage 3 to linear-regression-based limits in Stage 4 is one of the most impactful changes. This supports equity in compliance because it can prevent manufacturers from following more lenient requirements for their products by slightly increasing vehicle weight.

Table 1
Stage 4 per-vehicle fuel consumption limits (L/100 km, WLTC)

Test mass (TM)		TM ≤ 1,190 kg	1,190 kg < TM ≤ 2,850 kg	TM > 2,850 kg
Gasoline	Truck	6.09	$0.00375 \times (TM - 1,733) + 8.13$	12.32
	Bus	5.85	$0.00385 \times (TM - 2,098) + 9.35$	12.25
Diesel	Truck	5.19	$0.00297 \times (TM - 1,733) + 6.81$	10.13
	Bus	5.03	$0.00288 \times (TM - 2,098) + 7.65$	9.82

Notes: For vehicles with dump truck configuration, the per-vehicle limits are 5% higher than the limits for trucks.

5 Ministry of Ecology and Environment of China, 轻型汽车污染物排放限值及测量方法(中国第六阶段) [Limits and measurement methods for emissions from light-duty vehicles (CHINA 6)], 2016, https://www.mee.gov.cn/ywgz/fgbz/bz/bzwb/dqhbh/dqdywrwpfbz/201612/t20161223_369476.shtml; Ministry of Industry and Information Technology, 乘用车燃料消耗量评价方法及指标 [Fuel consumption evaluation methods and targets for passenger cars], 2019, <https://openstd.samr.gov.cn/bzgk/gb/newGbInfo?hcno=A0D5C7C6DE851F1FB293B6CA09C757EB>.

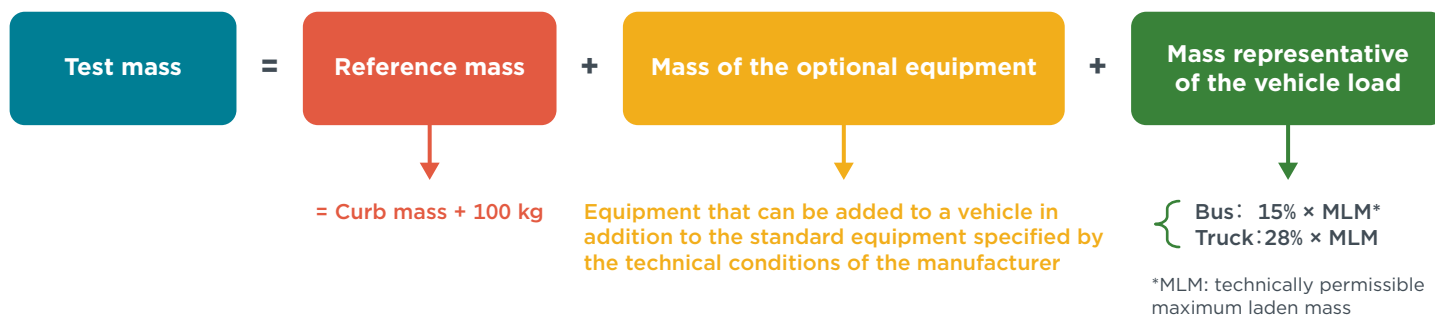
6 For details of this method, see Ministry of Industry and Information Technology of China, 压缩天然气汽车燃料消耗量试验方法 [Test methods for fuel consumption of compressed natural gas vehicles], 2012, <https://openstd.samr.gov.cn/bzgk/gb/newGbInfo?hcno=65DE3FAD756F606556D1CA07E3783DEC>; and Ministry of Industry and Information Technology of China, 甲醇汽车燃料消耗量试验方法 [Test methods for fuel consumption of methanol vehicles], 2021, <https://std.samr.gov.cn/hb/search/stdHBDetailed?id=C79CADF592FCFF2AE05397BE0A0A0074>.

TEST MASS

Different LCVs can have substantially different payloads, which is especially true for light commercial trucks. The Stage 4 standard accounts for this by using vehicle test mass instead of curb mass as the reference weight in its equations. As shown in Figure 2, various loads in addition to curb mass, including equipment and vehicle load, are included in test mass. The base weight for the calculation is heavier in the Stage 4 standard than in Stage 3, when curb mass was the basis. This allows for a more realistic capture of the fuel consumption limit of LCVs and aligns the standard with China's current vehicle emission standard, China 6.

Figure 2

Definition of test mass



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CORPORATE AVERAGE FUEL CONSUMPTION (CAFC)

The Stage 4 standard adds a CAFC management mechanism that introduces CAFC requirements and assigns stricter per-model fuel consumption limits in the CAFC requirement calculation. As shown in Table 2, the CAFC limits that apply in 2030 depend on test mass and they range from 4.27 L/100 km to 8.64 L/100 km for gasoline trucks; from 3.64 L/100 km to 7.09 L/100 km for diesel trucks; from 4.11 L/100 km to 8.59 L/100 km for gasoline buses; and from 3.54 L/100 km to 6.89 L/100 km for diesel buses.

Table 2

Stage 4 corporate average fuel consumption (CAFC) limits for 2030 (L/100 km, WLTC)

Test mass (TM)		TM ≤ 1,190 kg	1,190 kg < TM ≤ 2,850 kg	TM > 2,850 kg
Gasoline	Truck	4.27	$0.00263 \times (TM - 1,733) + 5.70$	8.64
	Bus	4.11	$0.00270 \times (TM - 2,098) + 6.56$	8.59
Diesel	Truck	3.64	$0.00208 \times (TM - 1,733) + 4.77$	7.09
	Bus	3.54	$0.00202 \times (TM - 2,098) + 5.37$	6.89

For each calendar year, each LCV produced in or imported by China must meet the per-vehicle standard, and each vehicle manufacturer's fleet-average fuel consumption must meet the CAFC target requirements. The CAFC target will phase in gradually starting in 2026: Manufacturers' actual CAFC values are allowed to be as much as 24% higher than their 2030 CAFC targets in 2026 and 2027, and 15% higher than their 2030 targets in 2028 and 2029. Equation 1 and Equation 2 below show how to calculate CAFC targets and CAFC actual performance values.

$$CAFC_{Target} = \frac{\sum_i^n (T_i \times V_i)}{\sum_i^n (V_i)} \quad (1)$$

Where:

- $CAFC_{Target}$ is the target corporate fleet-average fuel consumption (L/100 km)
- n is the total number of the vehicle models produced or imported by the corporation
- T_i is the CAFC-per-model fuel consumption limit of the i^{th} vehicle model (L/100 km; see Table 2)
- V_i is the number of i^{th} vehicle model produced or imported

$$CAFC_{Actual} = \frac{\sum_i^n (FC_i \times V_i)}{\sum_i^n (V_i \times W_i)} \quad (2)$$

Where:

- $CAFC_{Actual}$ is the actual corporate fleet average fuel consumption (L/100 km)
- n is the total number of vehicle models produced or imported by the corporation
- FC_i is the type-approval fuel consumption of the i^{th} vehicle model (L/100 km)
- V_i is the number of i^{th} vehicle model produced or imported
- W_i is the multiplier to which the i^{th} vehicle model corresponds (see Table 3 for multipliers allowed for different vehicles)

FLEXIBILITY

MULTIPLIERS

In the calculation of $CAFC_{Actual}$, the manufacturer of each NEV and energy-saving vehicle model is offered a multiplier through 2029; these phase out in 2030 (see Table 3). This provides advantages for corporations that comply with the standard by producing NEVs and energy-saving vehicles. From 2026 to 2030, the multipliers gradually decrease until the value is 1 and they remain at 1 afterward. This kind of phase-out schedule enhances stringency and retains the standard's impact on reducing fuel consumption when the market penetration of NEVs increases in the future.

Table 3
Multipliers for NEVs and energy-saving vehicles in the $CAFC_{Actual}$ calculation

Year	Vehicle type	
	BEV & FCEV & PHEV*	Energy-saving vehicle**
2026	1.4	1.2
2027	1.4	1.2
2028	1.2	1.1
2029	1.2	1.1
2030 and after	1	1

* PHEV here refers to a model with a pure electric range of ³ 50 km and with fuel consumption (excluding fuels converted from pure electric driving mode) that is 65% less than the corresponding per-vehicle fuel consumption limit in the Stage 4 standard.

** Energy-saving vehicle here refers to all non-electric vehicles with fuel consumption lower than or equal to the corresponding CAFC-per-vehicle limits.

OFF-CYCLE CREDITS

Corporations that produce vehicles with one or more off-cycle technologies are offered compliance flexibility by granting those vehicles fuel consumption waivers in the calculation of $CAFC_{Actual}$. However, the types of technologies considered, testing procedures, and the scale of the waivers will all be decided in another policy document to be released in the future.

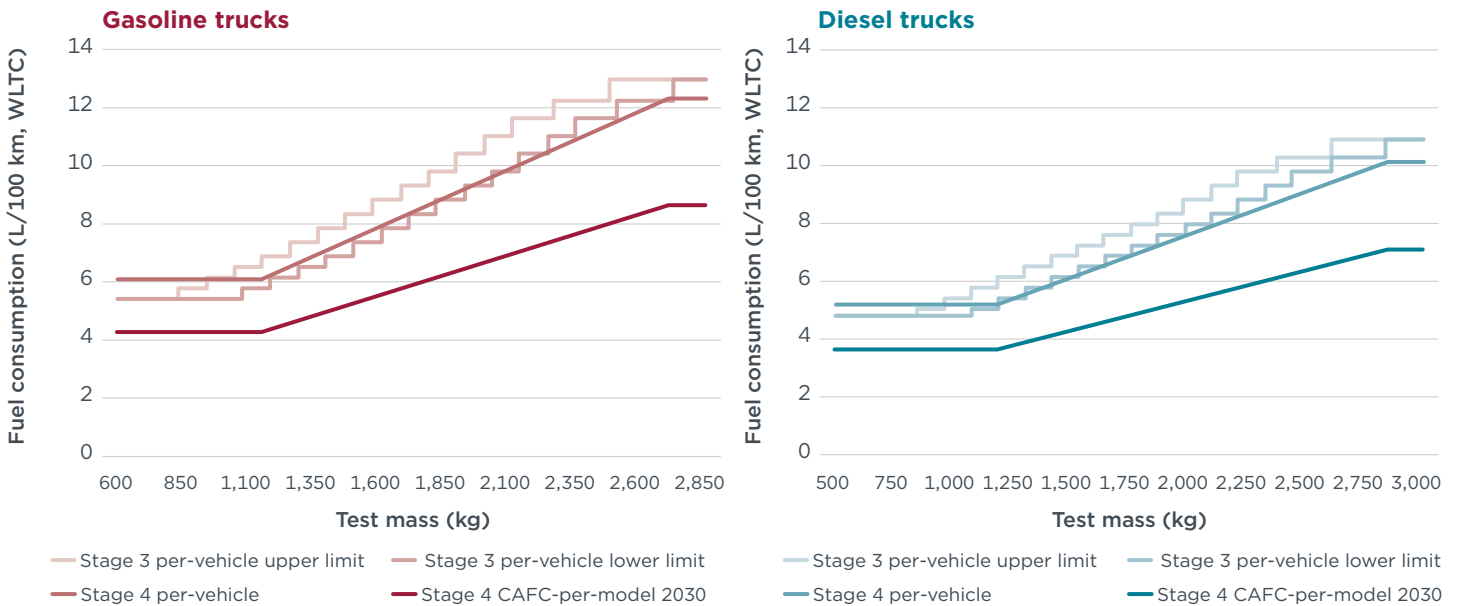
STANDARD COMPARISON

The standards for Stage 3 and Stage 4 are compared in Figure 3 (trucks) and Figure 4 (buses). To facilitate the comparison, we used the conversion formula given in the standard compilation illustration file to normalize the NEDC Stage 3 fuel consumption limit to the WLTC-equivalent:⁷

$Fuel\ Consumption_{WLTC} = 1.219 \times Fuel\ Consumption_{NEDC} - 1.289$ was used to convert the fuel consumption limit in Stage 3 under NEDC to that under WLTC.

Figure 3

Stage 3 and Stage 4 fuel consumption limits for trucks powered by gasoline and diesel



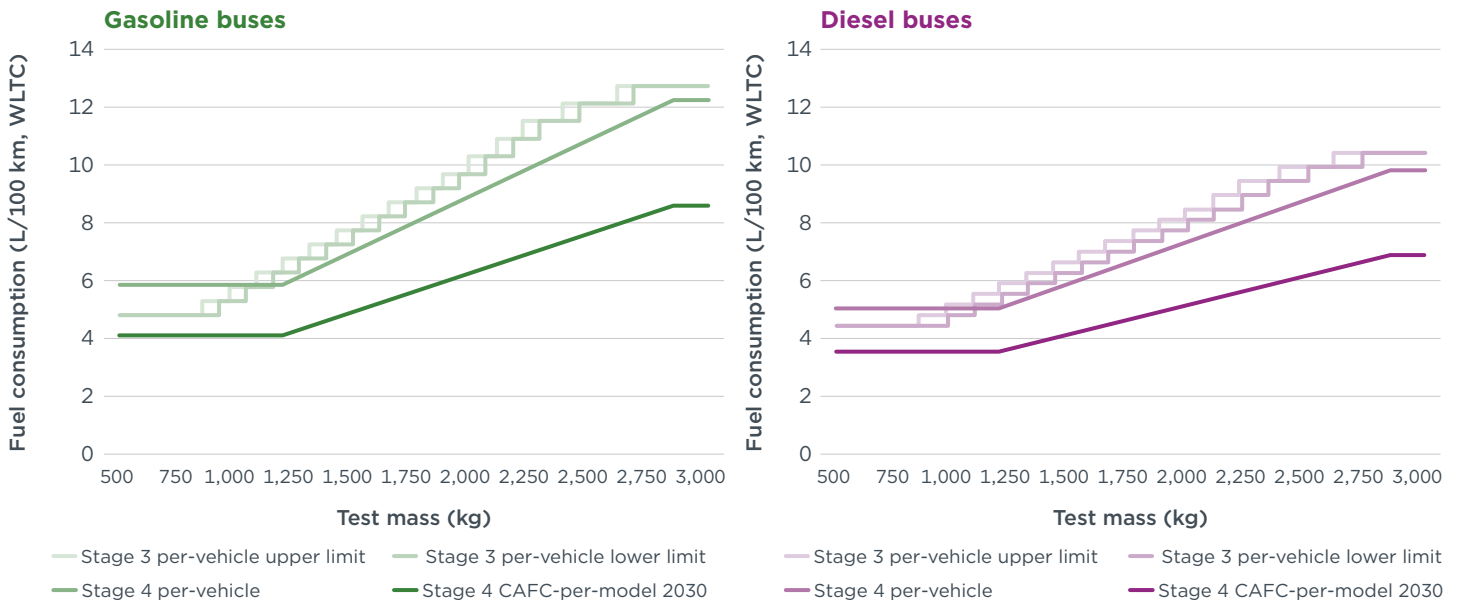
Note: The upper bound of the Stage 3 per-vehicle fuel consumption limit under the WLTC was calculated by assuming the test mass equals curb mass plus 100 kg, and we used the best-selling LCV model of each fuel and vehicle type in 2022 to represent the lower bound.

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⁷ An illustration file contains background information about drafting the standard. It is included with the version of the standard released for public consultation.

Figure 4

Stage 3 and Stage 4 fuel consumption limits for buses powered by gasoline and diesel

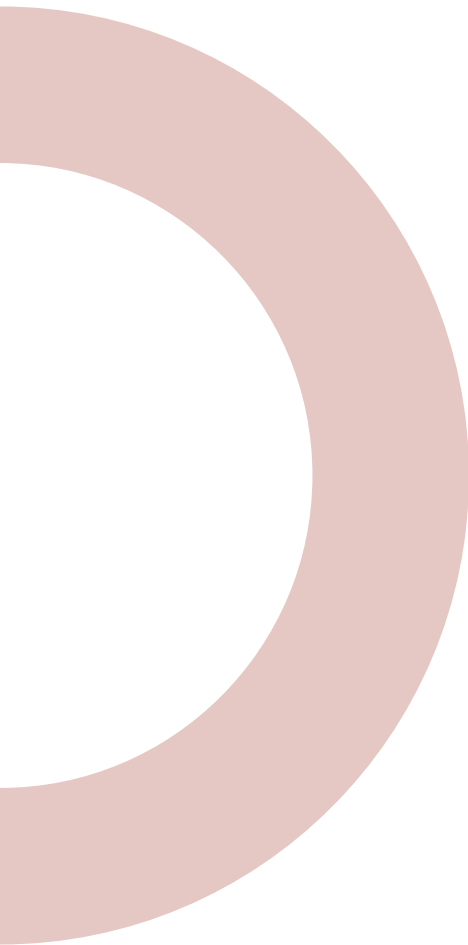


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NEXT STEPS

After it takes effect, the Stage 4 standard will be added to the market entrance requirements for new vehicles. A credit management system that offers credit banking and transfer options is expected to be published to ensure compliance and enforcement.



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