Perspective on Global Fuel Consumption and the CO₂ Regulatory Outlook

Purpose: Information
Submitted by: United States
Perspective on Global Fuel Consumption and the CO$_2$ Regulatory Outlook
通用汽车对油耗和碳排放的展望

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Global Fuel Economy, CO2 Regulatory Outlook in regionally specific countries or units

**Canada**
- 246gCO2/mi in 2016

**US-Federal**
- 35.5 mpg in 2016
- 54.5 mpg by 2025

**California**
- 80% CO2 reduction by 2050
- ZEV, PZEV rules

**Europe**
- **European Union**
  - 130gCO2/km in 2015
  - 95gCO2/km in 2020
  - Local CO2 taxation

**China**
- 6.9L/100km in 2015
- 5.0L/100km by 2020
- Local taxation

**Korea**
- 140g/km or 17km/L in 2015

**Japan**
- 16.8km/L in 2015
- 20.3km/L in 2020

**Mexico**
- 14.9 km/l by 2016

**India**
- 130 gCO2/km by 2016
- 113 gCO2/km by 2021

**Australia**
- 190gCO2/km in 2015
- 155gCO2/km by 2024
Passenger Car Global Fuel Economy and CO2 Outlook

乘用车燃油经济性及碳排放法规展望

[1] China’s target reflects fleet passenger vehicles only. Super credits are allowed to compliant to this target but with a reduced multiplier up to 2020.
[2] The U.S. standards are fuel economy standards set by NHTSA, which is slightly different from GHG standards due to A/C credits.
What makes China’s Car FE targets more aggressive than EU
市场差异导致中国油耗目标更难达到

China fuel economy regulatory scheme is similar to EU (same cycle, similar targets). The 2020 outlook of EU fuel economy and CO2 regulatory target seems to be more severe than China’s outlook, but in reality China’s FE standard more difficult to meet cost effectively.

中国油耗法规采用欧洲类似的机制，测试循环相同，目标值接近。从字面上看，欧盟2020年的远景目标要求更高，但从实际情况看，中国达标的困难更大。

EU has a smaller car mix in the fleet
欧洲车辆构成中，小型车辆比例更高。

EU has much higher percentage of diesel usage
柴油机在欧洲占大量比例，燃油效率更高，CO2排放更少。

EU has more manual transmissions
欧盟有更高比例手动变速箱，其传动效率比自动变速箱高。

Percentage of Diesel Engine
柴油机占比情况
Data from ICCT

Percentage of Manual Transmission
手动变速箱占比情况
Data from IIHS

Percentage of Portfolio Mix
车队构成情况
Data from IIHS

2013 Segmentation
Addressing Fuel Economy, CO2 Regulatory Requirements
针对严格的油耗及碳排放法规的一揽子解决方案

- To address these challenges, a diversity of solutions and a broad portfolio of fuel economy technologies will be required:

为应对越来越严格的油耗和碳排放挑战，提供一个组合多种技术节油技术的一揽子解决方案，包括以下内容：

- Electrification, requires product/technology/market readiness, and has specific challenges on cost and infrastructure.

  电气化策略，需要在产品/技术/市场需求作准备，面临特别的成本及基础设施的挑战

- Clean diesels, are a cost effective approach to fuel economy. More than 50% of EU portfolio are diesels. Diesels have around 4% penetration in US today and projected to grow... but also have associated infrastructure challenges for some markets.

  清洁柴油机能很经济地达到油耗目标，欧盟市场超过50%的产品应用柴油机。目前美国市场柴油机占比约为4%，预期2019年增长到8%。

- Off cycle technologies, address real world savings in a cost effective manner, government need to provide incentives for these technologies in the form of credits.

  政府部门应当奖励一些在测试工况下不体现，实际使用时能节油的技术，比如提供额外的奖励。
GM Electrification Portfolio of solutions - full range of vehicles that provide customer choice
通用汽车的电气化方案覆盖各种技术措施，提供给消费者多样化选择

- **Mild Hybrids** – eAssist on Buick LaCrosse
  轻混 – 别克君越eAssist

- **Full Hybrids** – 2-Mode hybrid system on Cadillac Escalade
  强混 – 凯迪拉克凯雷德双模混合动力

- **Plug-In Hybrids (PHEV)**
  插电式混合动力

- **Extended-Range Electric Vehicles (EREV)** – Chevrolet VOLT, Cadillac ELR
  增程型电动车 – 雪佛兰VOLT沃蓝达, 凯迪拉克ELR

- **Battery Electric** – Spark BEV and Sail SPRINGO EV
  纯电动车 – 斯帕可纯电动车和赛欧SPRINGO纯电动车

- **Fuel Cell** - Equinox
  燃料电池汽车

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**Petroleum and Biofuels** (Conventional and Alternative Sources)
石油与生物燃料（传统与可替代能源）

**Electricity and Hydrogen** (Zero Emissions Energy Sources)
电力与氢动力（零排放能源）

**Increasingly Electrified Powertrains**
不断改善的电气化动力系统
Diesel – Global Perspective and Cost Effective FE Solution
柴油机——全球推广的低成本提高燃油经济性解决方案

- Diesels are a cost effective enabler that are inherently more FE efficient than gasoline; 柴油机比汽油机油耗更低，是一种经济的降低油耗解决方案；
  - 25% - 30% FE improvement 燃油经济性高25%-30%
  - Mature technology 成熟的技术
  - Cost effective solution with 5~6 year payback 费效比高; 消费者5~6年成本回收期
  - Specific infrastructure challenges in some regions 在某些地区面临特殊的基础设施挑战

US 美国
- ~ 4% penetration today 目前约为4%
- ~ 7.9% by 2019 预计2019年达到7.9%

EU 欧盟
- 55% today 目前55%
- Be stable ~ 50% by 2020 到2020年稳定在50%左右

EU Diesel Penetration Assumptions:
- 5 to 10 cent on a WE basis
- Additional investment in diesel refinery capacity
- CO2 taxation will increase
- Performance/Run-to-drive factors will continue to have positive impact on diesel demand

On cost for gas engines due to Euro 5 and 6 are minor vs Diesel.
Additional cost for Euro 5 vs Euro 4 approx. 300€ (Diesel).
e.g. SCR aftertreatment adds 600-700€ to MOE vs Euro 5.
Off Cycle Credits – Global Applicability
工况外节油优惠——全球采用的鼓励创新的政策

- Many real-world vehicle fuel economy enablers are not recognized in the standard vehicle fuel economy tests (U.S. FTP, EU and China NEDC, etc.).
  许多在实际使用中影响燃油消耗的条件在测定汽车油耗的标准（比如美国城市和高速工况测试和欧盟NEDC测试）中没有体现。

- Regulatory credit programs have been created in the U.S. and Europe to incentivize real-world fuel consumption improvements that do not appear on the standard test procedures.
  美国和欧盟已经制定法规奖励那些在标准测试工况中未体现，但是在实际使用中能节油的技术。
    - U.S. has implemented the Mobile Air Conditioner (MAC) credits and Off Cycle credits.
      美国称作MAC credits（汽车空调优惠）和Off Cycle credits（工况外节油优惠）
    - In the EU, these are referred to as Eco-Innovation Credits.
      欧盟称作Eco-Innovation Credits（节能新技术优惠）

- These “flexibility mechanisms” are an indispensable part of the programs in both North America and Europe to achieve the very stringent goals/standards.
  这些弹性机制是北美和欧盟极其严苛的碳排放和燃油经济性标准不可或缺的重要组成部分。
    - The MAC, off cycle and eco-innovation credits are a significant portion of the fuel consumption and CO2 reductions planned in the European and North American regulatory programs.
      在欧洲和北美即将实行的燃油经济性和降低CO2排放法规中，MAC，Off Circle和Eco Innovation相关的激励措施是其中的重要部分。
Off Cycle – An Innovative Enabler for Energy Saving and Reduction of Greenhouse Gas

• Regulators in North America and in Europe are beginning to regulate areas of the vehicle that were not previously regulated

• Reduction of greenhouse gases is the primary goal

• Regulators also want reduced energy consumption in all aspects of the vehicle

– Mobile Air Conditioner (MAC) consumes the most energy of any accessory
– Reduced energy consumption from other “off-cycle” conditions

• No one standard can consider all vehicle running conditions

– Very high-speed driving
– Very low-speed driving in congested traffic
– Driving in hot weather with the air conditioner on
– Using vehicle accessories such as the exterior lights, radios, navigation systems, etc.

• The improved efficiency of these off cycle technologies provide real world benefits and allow vehicles to go farther on a liter of gas and while reducing GHG emissions
## CO2 Regulatory Overview US, EU and China

### USA

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<tr>
<th>Target</th>
<th>Measure Type</th>
<th>PV 2016</th>
<th>PV 2025</th>
<th>LCV 2016</th>
<th>LCV 2025</th>
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<th>PV 2025 95 gCO2/km</th>
<th>LCV 2017 175gCO2/km</th>
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### EU

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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6.9L/100km</td>
<td>5L/100km</td>
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### China

<table>
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<th>Target</th>
<th>Measure Type</th>
<th>2015 6.9L/100km</th>
<th>N/A</th>
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</table>

### Flexibility

- **Air conditioner refrigerant credit up to 13.8 gCO2/mi**
- **Air conditioner efficiency credit up to 5 gCO2/mi**
- **Off-circle credit up to 10 gCO2/mi**
- **Eco-innovations up to 7g/km**
- **3 year carry forward/backward credits**
- **Penalty**

### Penalty

- **NHTSA based CAFE penalties are not cost prohibitive.**
- **EPA based GHG fines are assessed per vehicle and are prohibitive.**
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Global Fuel Economy, CO2 Regulatory Outlook
Summary
全球燃油经济性，碳排放法规概览总结

• To answer the fuel economy, CO2 emission challenges globally, there is no
  one single solution that can address these challenges
为应对全球燃油经济性和碳排放要求的挑战，没有哪一个方案能独自解决问题。

• We believe a diversity of solutions and broad portfolio of fuel economy
  enabling technologies will be required
我们相信以下多种解决方案和措施能帮助应对燃油经济性所面对的挑战。
  – Implementation of electrification strategy
    应用电气化的策略
  – Diesels are a cost effective approach to fuel economy
    柴油机是一种有效且经济的方案
  – Off cycle credits address real world savings in a cost effective manner, government
    need to provide incentives for these technologies.
    标准工况外奖励体现实际车辆中节省的燃油，政府部门应当鼓励厂商采用这些技术。
Thank you . . . for your attention!