Global Overview on Vehicle Fuel Economy and Emission Standards

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Analysis of trends, issues and policy options
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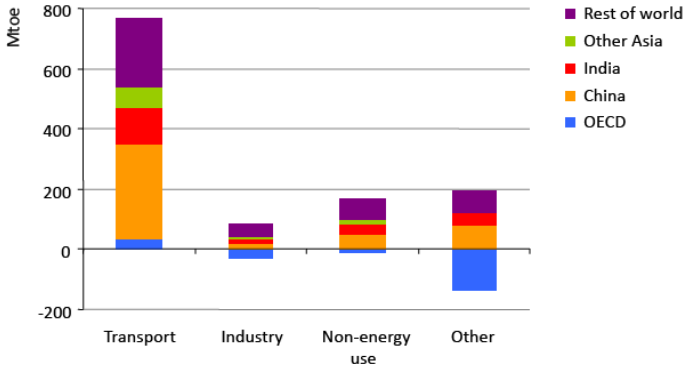
The Innovation Center for Energy and Transportation (*i*CET, www.icet.org.cn)

Located in Beijing and Los Angeles, *i*CET is a China and California registered, non-profit, independent, leading policy center in low-carbon development and climate ch

- **Low Carbon Transportation**
  - Fuel Economy Standards for China
  - Green Car Online Rating System
  - Low Carbon Fuel Standards and Policies
  - Electric Vehicle Research and Promotion
- **Clean Energy and Energy Efficiency Programs**
  - Lighting technologies (LED light standards and related policies)
  - US-Jiangsu Green Partnership (solar energy)
- **Climate Change Program**
  - Energy and Climate Registry (ECR) in China
- **Conferences and Outreach**



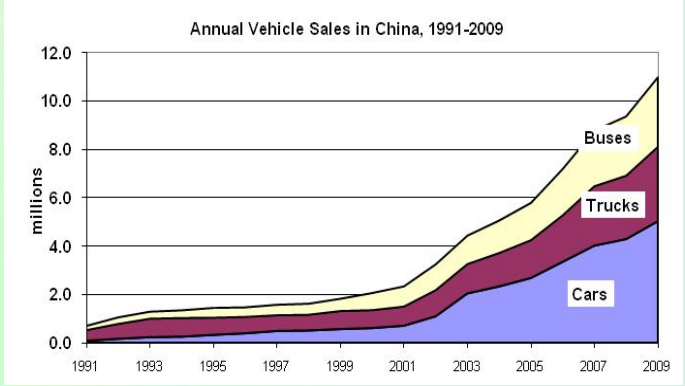

WEO 2008 Reference Scenario: Incremental oil demand, 2006-2030



Around three-quarters of the projected increase in oil demand comes from transportation

China projects to be the #1 auto market this year, surpassing 11 million unites. Car market exploded in the past decade.

Annual growth in new car sales averaged about 24% since '92, trucks 10%, buses 15%



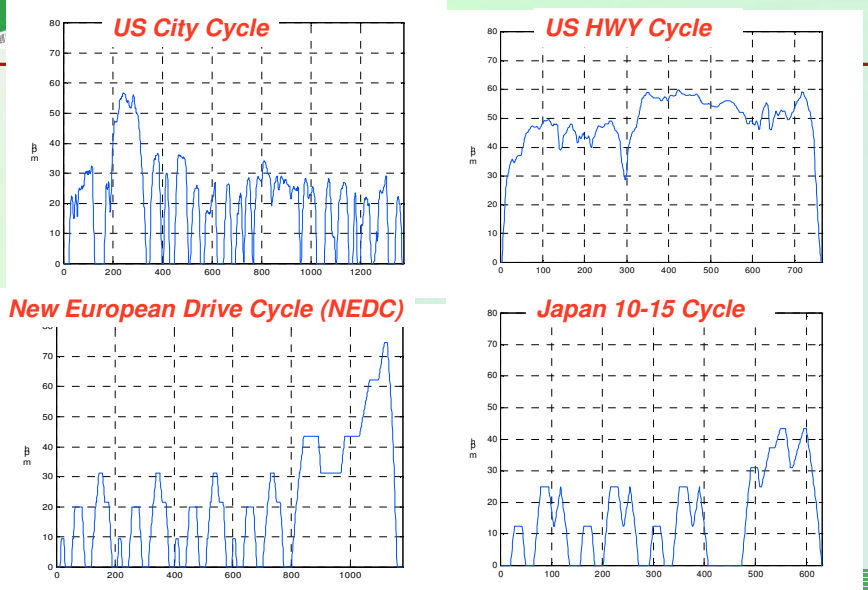
Overview of Countries and Regions that have Vehicle Fuel Efficiency and GHG Standards

At-least nine countries and regions have established or proposed motor vehicle fuel efficiency or GHG emission policies. Due to various historic, cultural and political reasons, different countries and regions chose to adopt different fuel efficiency or GHG standards.

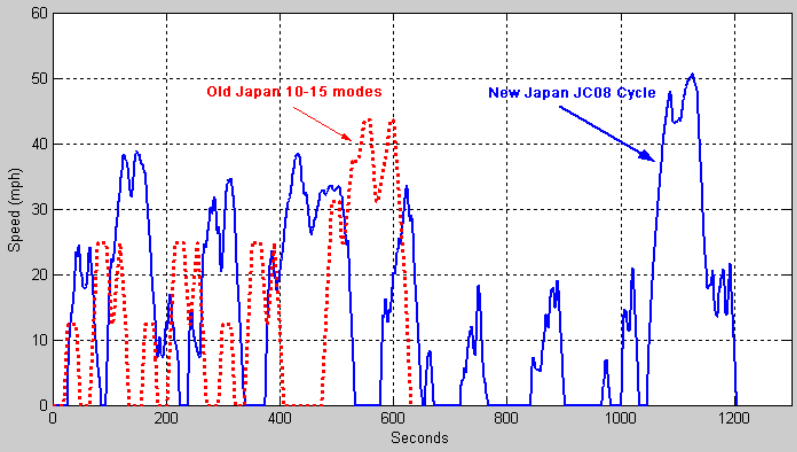
Country/region	*Type*	*Measure*	*Structure*	*Test method*[a]	*Implementation*
United States	Fuel	mpg	Cars and light trucks	U.S. CAFE	Mandatory
European Union	CO_2	g/km	Overall light - duty fleet	EU NEDC	Voluntary
Japan	Fuel	km/L	Weight-based	Japan 10-15	Mandatory
China	Fuel	L/100-km	Weight-based	EU NEDC	Mandatory
California	GHG	g/mile	Car/LDT1 and LDT2	U.S. CAFE	Mandatory
Canada	Fuel	L/100-km	Cars and light trucks	U.S. CAFE	Voluntary
Australia	Fuel	L/100-km	Overall light-duty fleet	EU NEDC	Voluntary
Taiwan, South Korea	Fuel	km/L	Engine size	U.S. CAFE	Mandatory

[a]Test methods include U.S. Corporate Average Fuel Economy (CAFE), New European Drive Cycle (NEDC), and Japan 10-15 Cycle. See Appendix for more details.

Differences in test driving cycles are crucial



Revised Japanese Test Cycle – New JC08 Cycles



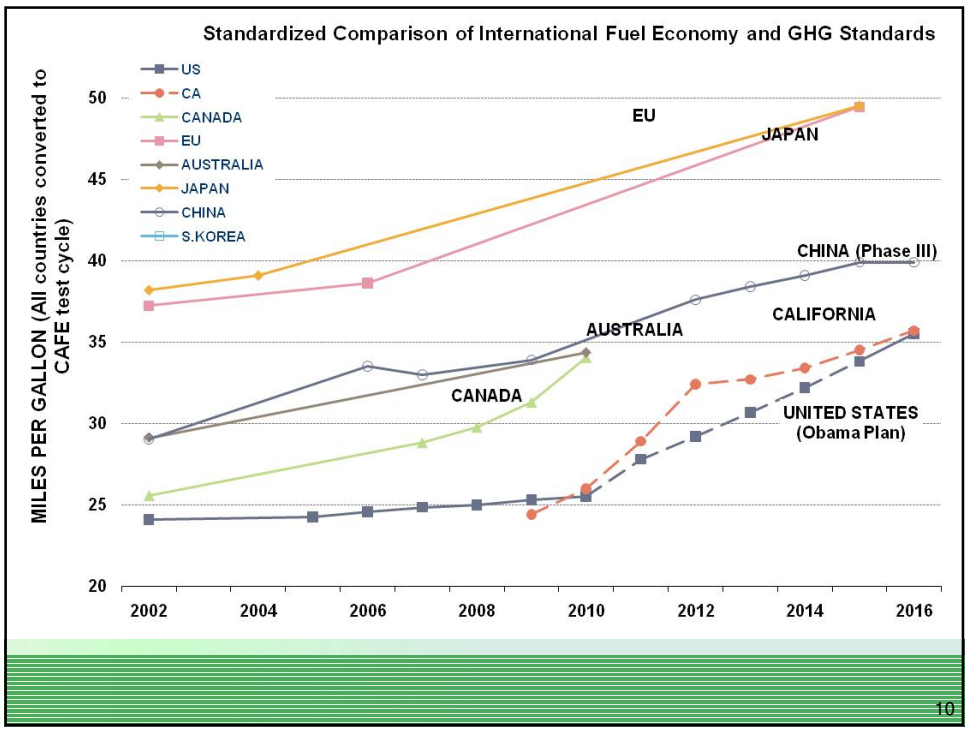
Structures of Fuel Economy/GHG Standards Vary Greatly Among Countries/Regions

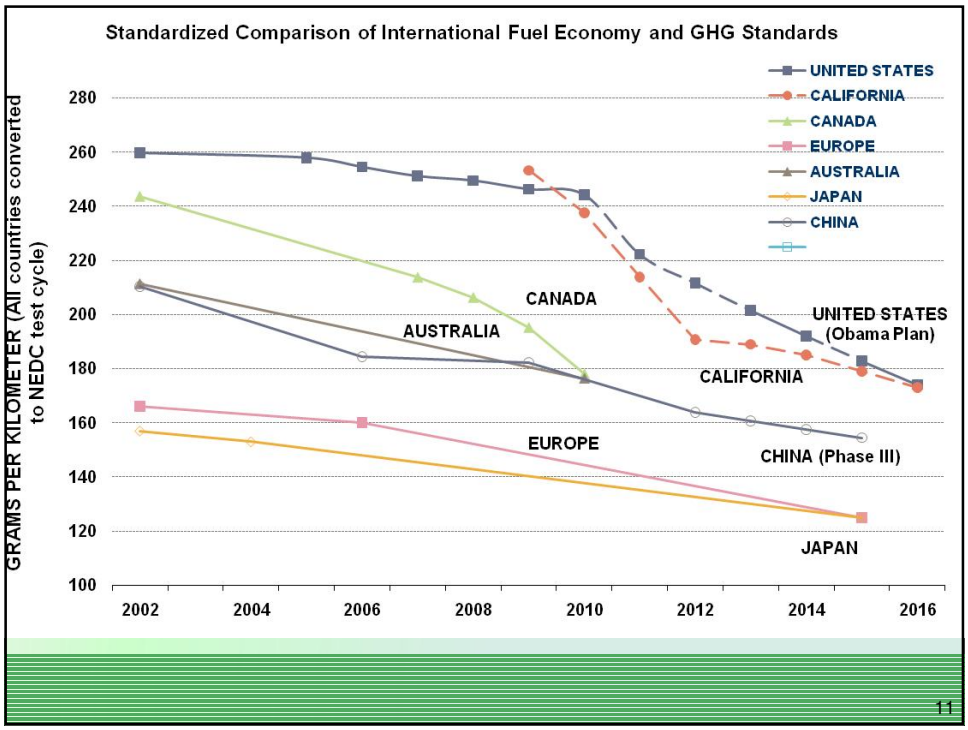
- *Fleet Average Target:*
  - *EU (CO_2, g/km)*
  - *Australia (L/100-km)*
- *Divided by Vehicle Categories*
  - *US, Canada (mpg) - Cars and LDTs,*
  - *California (CO_2, g/mile) - (PC/LDT1, LDT2)*
- *Based on Vehicle/engine attributes:*
  - *Vehicle Test Weight Bins*
    - *Japan (km/L) - 9 weight classes*
    - *China (L/100-km) - 16 weight classes*
  - *Based on Engine Size*
    - *Taiwan, South Korea (km/L)*
  - *Based on Vehicle Footprint*
    - *Newly adopted US, EU standards*

Test Cycle Conversion Factors

Conversion factors from measures of different countries/regions to CAFE-equivalent MPG, EU-equivalent CO_2 in g/km, and California-equivalent CO_2 emission rate of g/mile

Country	*Cycle*	*Type*	*Measure (Y)*	*Converted to CAFE-equivalent mpg*		*Converted to EU-equivalent CO_2 (g/km)*		*Converted to CA-equivalent CO_2 (g/mi)*	
United States	U.S. CAFE	Fuel	mpg	Y *	1.00	1/(Y) *	6,180	1/(Y) *	8,900
Taiwan	U.S. CAFE	Fuel	km/L	Y *	2.35	1/(Y) *	2,627	1/(Y) *	3,783
South Korea	U.S. City	Fuel	km/L	Y *	2.78	1/(Y) *	2,226	1/(Y) *	3,206
Canada	U.S. CAFE	Fuel	L/100-km	1/(Y) *	235.2	Y *	26.2	Y *	37.8
California	U.S. CAFE	CO_2	g/mi	1/(Y) *	8,900	Y *	0.69	Y *	1.00
European Union (gasoline)	NEDC	CO_2	g/km	1/(Y) *	6,180	Y *	1.00	Y *	1.44
European Union (diesel)	NEDC	CO_2	g/km	1/(Y) *	7,259	Y *	1.00	Y *	1.44
Japan	Japan	Fuel	km/L	Y*	3.18	1/(Y) *	1,946	1/(Y) *	2,803
China, Australia	NEDC	Fuel	L/100-km	1/(Y) *	265.8	Y *	23.2	Y *	33.5





May 19th Presidential Announcement

- Harmonized national policy on light-duty vehicles
  - EPA to set first-ever GHG standards for MY2012-2016
  - NHTSA to increase CAFE standards for MY2012-2016
  - California and 13 other states agree federal compliance will be deemed compliance with California standards
  - Automakers agree to dismiss litigation
- Notice of Upcoming Joint EPA-NHTSA Rulemaking
  - Target of 250 g/mi CO2 for MY2016 vehicles
  - This is equivalent to 35.5 mpg, but CAFE standard will likely be somewhat lower

Historical Importance

- First-ever federal vehicle GHG standards
- Likely one of the "biggest" federal rules ever
  - 900 MMT of cumulative CO2 savings
  - 1.8 billion barrels of cumulative oil savings
  - $60 billion of cumulative incremental vehicle costs
  - $200 billion of cumulative consumer fuel savings
- Unprecedented cooperation
  - EPA and NHTSA standard-setting
  - Automakers/UAW and States/environmental groups

EPA MY2012-2016 GHG Standards Structure

- Vehicle tailpipe CO2 emissions minus credits for A/C-related CO2-e emissions reductions
  - Lower GWP refrigerants or reduced leakage
  - More efficient A/C systems
- Footprint-based GHG curves
  - Larger vehicles have higher GHG targets
  - Each manufacturer has unique fleetwide standard
- Retain separate car and truck standards
  - Include largest SUVs in trucks
  - Move small, 2WD SUVs from trucks to cars
- CAFE-like FFV credits through MY2015, then end
- No GHG fines, but temporary, less stringent standard for smaller automakers

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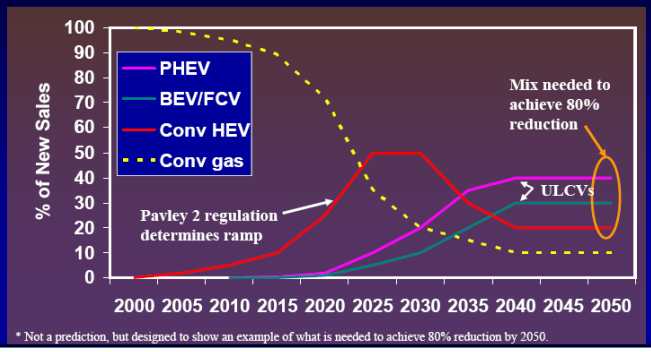
California retains independence in making its own GHG standards

CARB is working on Pavely 2 Regulations for post- 2016 – Likely 60-80+ MPG requirements for Ultra Low Carbon Vehicles (ULCVS)

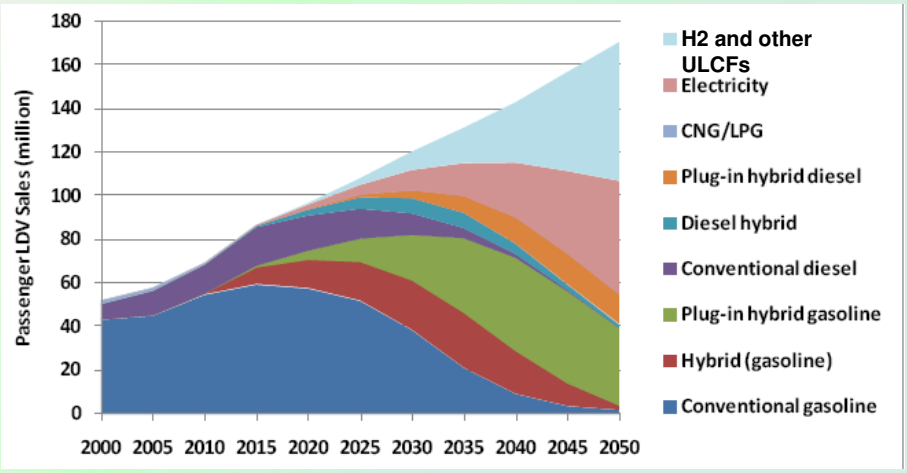
Example of Possible* Ultra Low Carbon Vehicle Introduction Rates



* Not a prediction, but designed to show an example of what is needed to achieve 80% reduction by 2050.

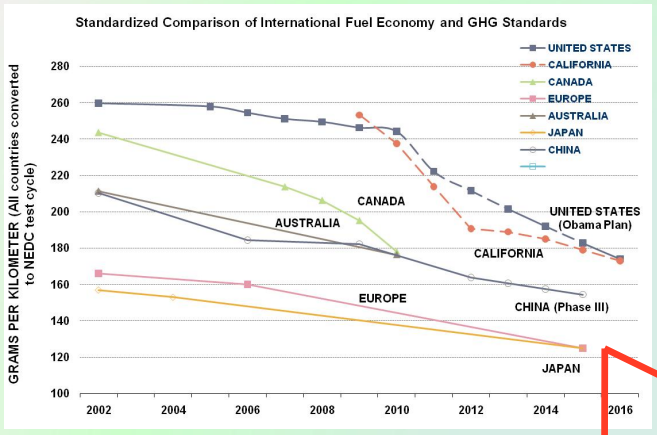
Road Map for 50% GHG reduction by 2050

PHEV/EV and Ultra Low Carbon Fuels are the Keys



De-carbonize transportation

Our only hope is to Decouple Carbon Emissions and Vehicle Ownership!



0.0 g/km

2050

Conclusions

- Worldwide vehicle sales will continue to grow in the foreseeable future
- Oil consumption will continue to grow under BAU scenario
- A series of global fuel-efficiency programs have been undertaken
- However, current actions insufficient to make fundamental reversion of GHG growth, not to mention a 50% GHG reduction target by 2050
- Much more aggressive targets and strategies are urgently needed
- A paradigm shift and transformation to decouple carbon emissions from vehicle ownership is critical
- Will PHEVs/EVs and ultra-low carbon fuels be our best hope?