Global Light-Duty Vehicle Fuel Economy Standards

全球轻型车燃油经济性标准

Drew Kodjak

June 4, 2014
GFEI/ICCT workshop
Beijing, China

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

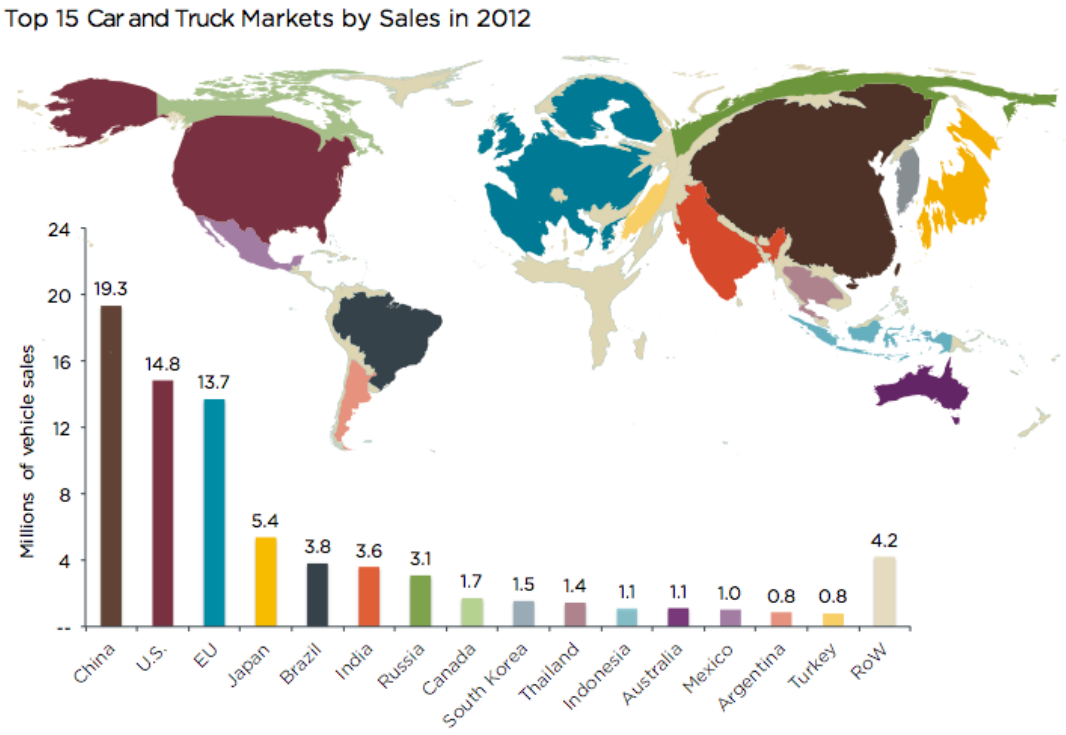
Who we are

International Council Composed of top government regulators (~25) in major markets founded in 2001.

Non-profit Organization
ICCT incorporated to serve International Council, staff of 35 technical experts on vehicles and fuels, half with background / nationality outside US founded in 2005. Offices in DC, San Francisco and Berlin. China office coming later this year.

Board of Directors
Dan Greenbaum, head of Health Effects Institute, chair of ICCT board.

Funding
California philanthropies plus government grants and contracts.



Mission: To dramatically improve environmental performance and efficiency of motor vehicles (cars, trucks, marine, aviation) and fuels by supporting government regulatory agencies in world's top vehicle markets.

Geographic scope: China, US, EU, Japan, Brazil, India, Canada, Korea, Indonesia, Australia, Mexico plus smaller markets by request.

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

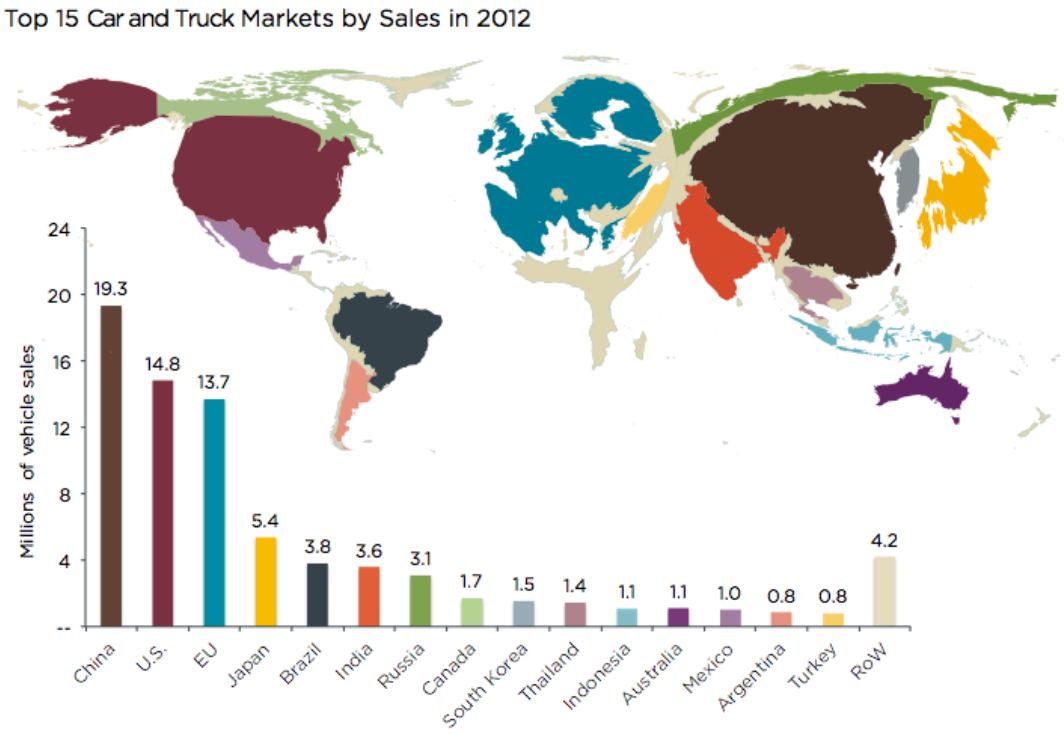
我们是谁

国际委员会 2001年建立，由主要机动车市场的高层政府管理者组成（约25人）

非政府组织 ICCT 为了服务于国际委员会在2005年成立，由35个机动车和燃油的技术专家组成，其中一半具有国外经验。在华盛顿特区、旧金山、柏林设有办公室。中国办公室将于今年建立。

董事会
Dan Greenbaum, Health Effects Institute主席, ICCT董事会主任.

资金
加州慈善基金会、政府资金与合同



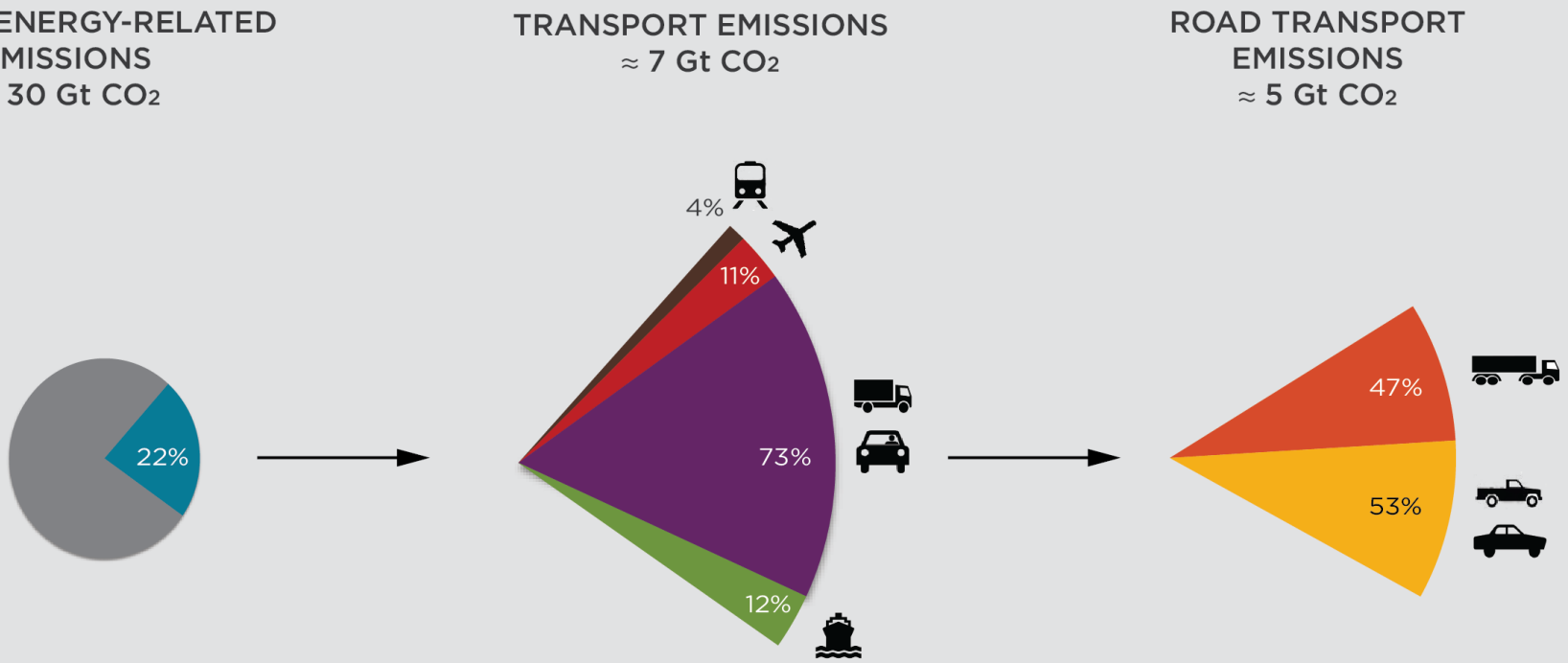
使命: 通过对主要机动车市场政府研究机构的支持，大幅度提高乘用车、卡车、公交车和交通系统的环境绩效和效率

覆盖区域: 中国、美国、欧盟、日本、巴西、印度、加拿大、韩国、印度尼西亚、澳大利亚、墨西哥和其他有需求的小市场

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

THE TRANSPORTATION SECTOR

A major contributor to global energy-related CO_2 emissions



LEGEND

RAIL | AIR | ROAD | SEA | HEAVY-DUTY VEHICLES | LIGHT-DUTY VEHICLES

Sources:
ICCT (2014). Global Transportation Roadmap Model. Version 2.0. More information available at http://www.theicct.org/global-transportation-roadmap-model.
IEA (2012). CO2 Emissions from Fuel Combustion: Highlights. 2012 edition. Retrieved from https://www.iea.org/co2highlights/co2highlights.pdf.

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Performance standards, economic signals, and technological innovation complement each other.

性能标准、经济信号、技术创新相互补充

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Overview of Passenger Vehicle Fuel Economy Standards Globally
全球乘用车燃油经济性标准概览

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

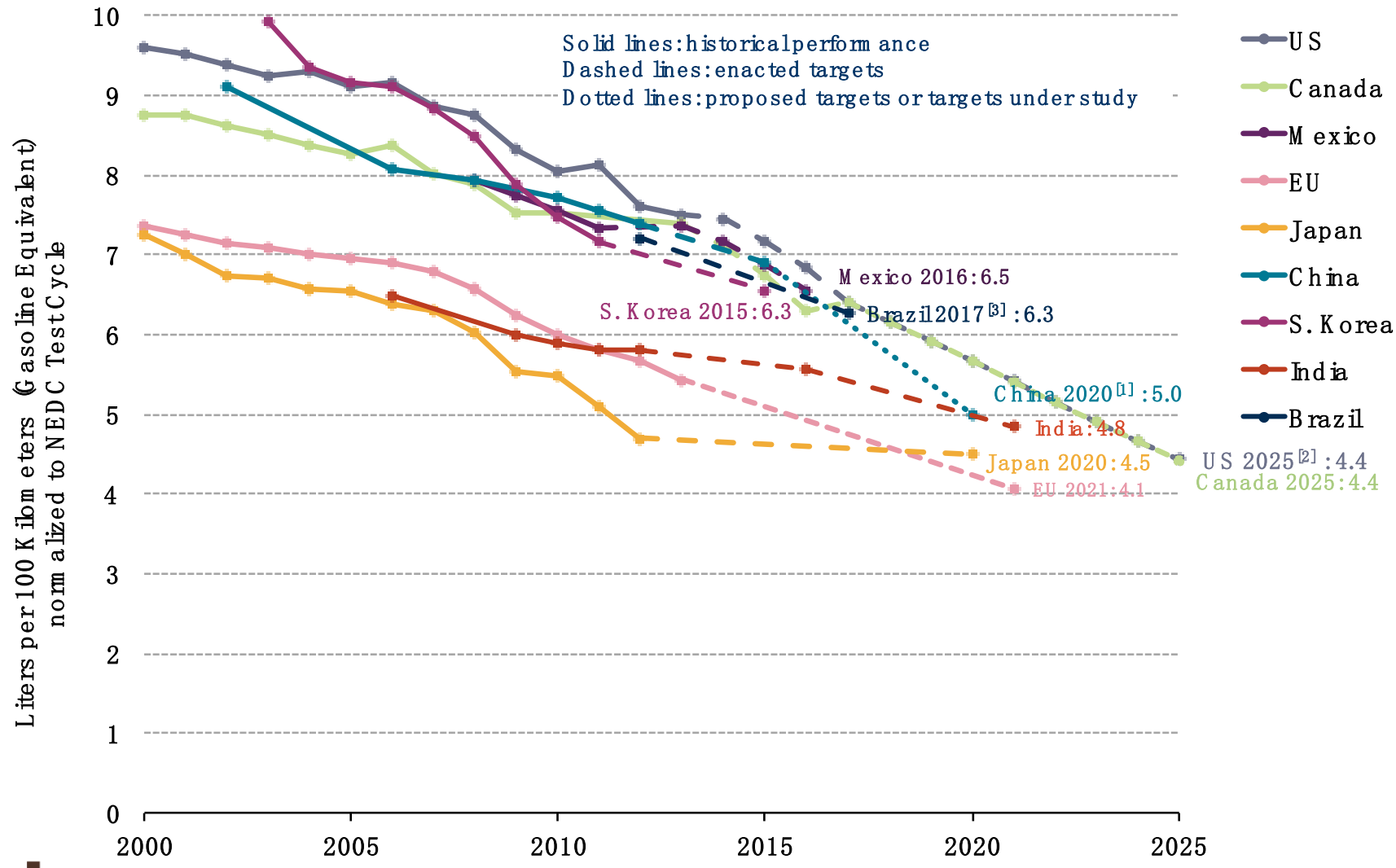
Overview of Regulation Specifications for passenger cars
乘用车具体政策概览

Country or Region	Target Year	Standard Type	Unadjusted Fleet Target/Measure	Structure	Test Cycle
EU	2015 2021	CO_2	130 gCO_2/km 95 gCO_2/km	Weight-based corporate average	NEDC
China	2015 2020 (proposed)	Fuel consumption	6.9 L/100km 5 L/100km	Weight-class based per vehicle and corporate average	NEDC
U.S.	2016 2025	Fuel economy/ GHG	36.2 mpg[i] or 225 gCO_2/mi 56.2 mpg[ii] or 143 gCO_2/mi	FP-based corporate avg.	U.S. combined
Canada	2016 2025 (proposed)	GHG	217 gCO_2/mi[iii] N/A[iv]	FP-based corporate avg.	U.S. combined
Japan	2015 2020	Fuel economy	16.8 km/L 20.3 km/L	Weight-class based corporate average	JC08
Brazil	2017	Fuel economy	1.82 MJ/km	Weight-based corporate average	U.S. combined
India	2016 2021	CO_2	130 g/km 113 g/km	Weight-based corporate average	NEDC for low-powered vehicle
South Korea	2015	Fuel economy/GHG	17 km/L or 140 gCO_2/km	Weight-based corporate average	U.S. combined
Mexico	2016	Fuel economy/GHG	39.3 mpg or 140 g/km	FP-based corporate avg.	U.S. combined

[i] Assumes manufacturers fully use A/C credit
[ii] Proposed CAFE standard by NHTSA. It is equivalent to 163g/mi plus CO2 credits for using low-GWP A/C refrigerants.
[iii] In April 2010, Canada announced a target for light-duty vehicle fleet of 246 g/mi for MY2016. The separated targets for car and light truck fleet are estimated by ICCT based on the overall target.
[iv] Canada follows the US standards in the proposal, but the final target value would be based on the projected fleet footprints.
FP: footprint

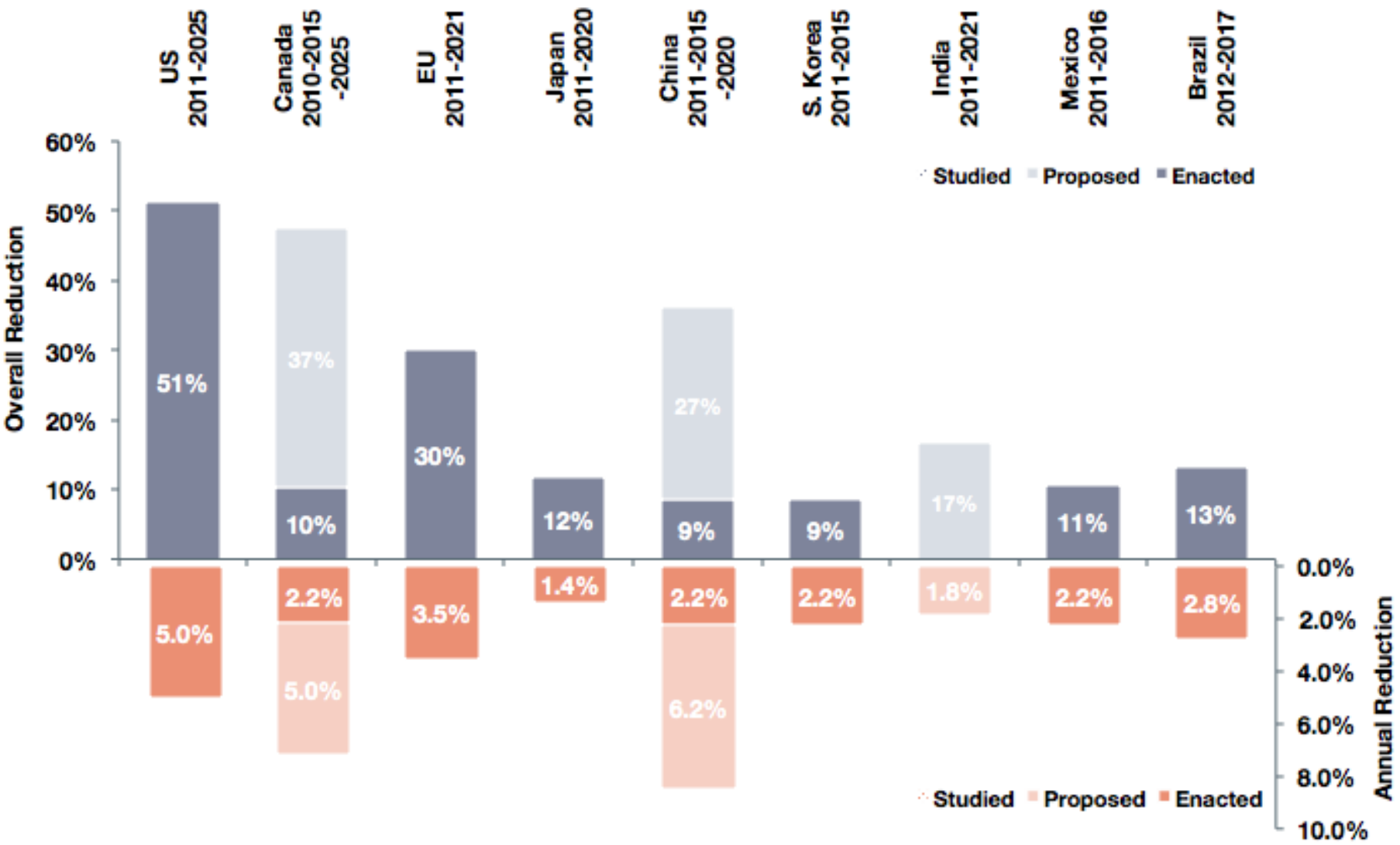
icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Passenger Car Fuel Economy Standards Globally
全球乘用车燃油经济性标准



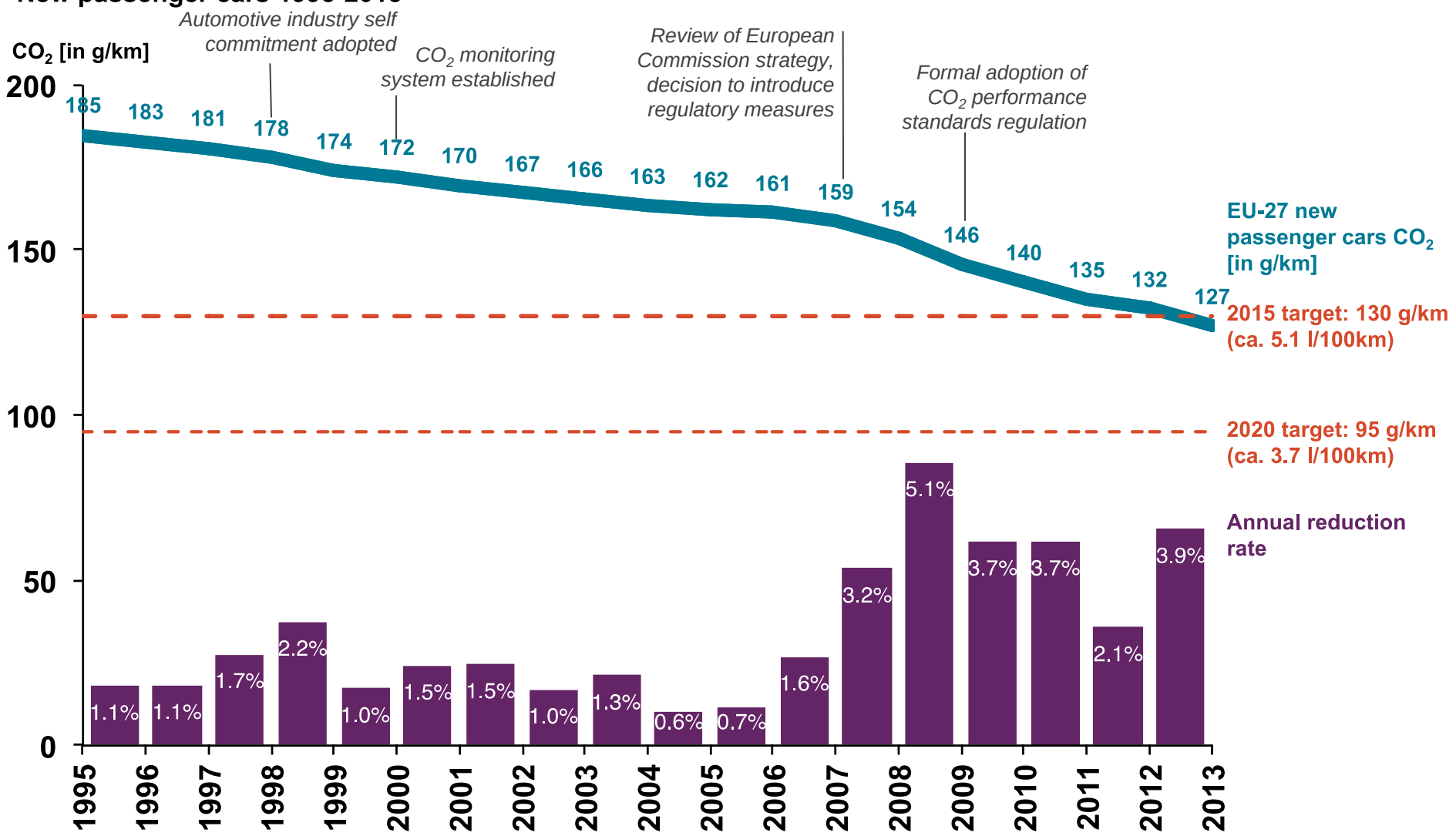
[1] China's target reflects gasoline vehicles only. The target may be higher after new energy vehicles are considered.
[2] The U.S. standards are fuel economy standards set by NHTSA, which is slightly different from GHG stadards due to A/C credits.
[3] Gasoline in Brazil contains 22% of ethanol (E22), all data in the chart have been converted to gasoline (E00) equivalent
[4] Supporting data can be found at: http://www.theicct.org/info-tools/global-passenger-vehicle-standards.

Overall and annual CO_2 reduction rates required for passenger cars
各国乘用车总量和每年CO_2减排幅度



CO_2 performance standards in the European Union

New passenger cars 1995-2013



Data sources: 1995-1999 ACEA data for EU-15; 2000-2013 EU CO_2 monitoring data (2000-2003 EU-15, 2004-2006 EU-25, 2007-2013 EU-27). Note that changes in the number of member states (from 15 to 27) have only minor effects on the overall emission level (about 0.5 g CO_2/km) as passenger car sales numbers in the new member states are relatively low.

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

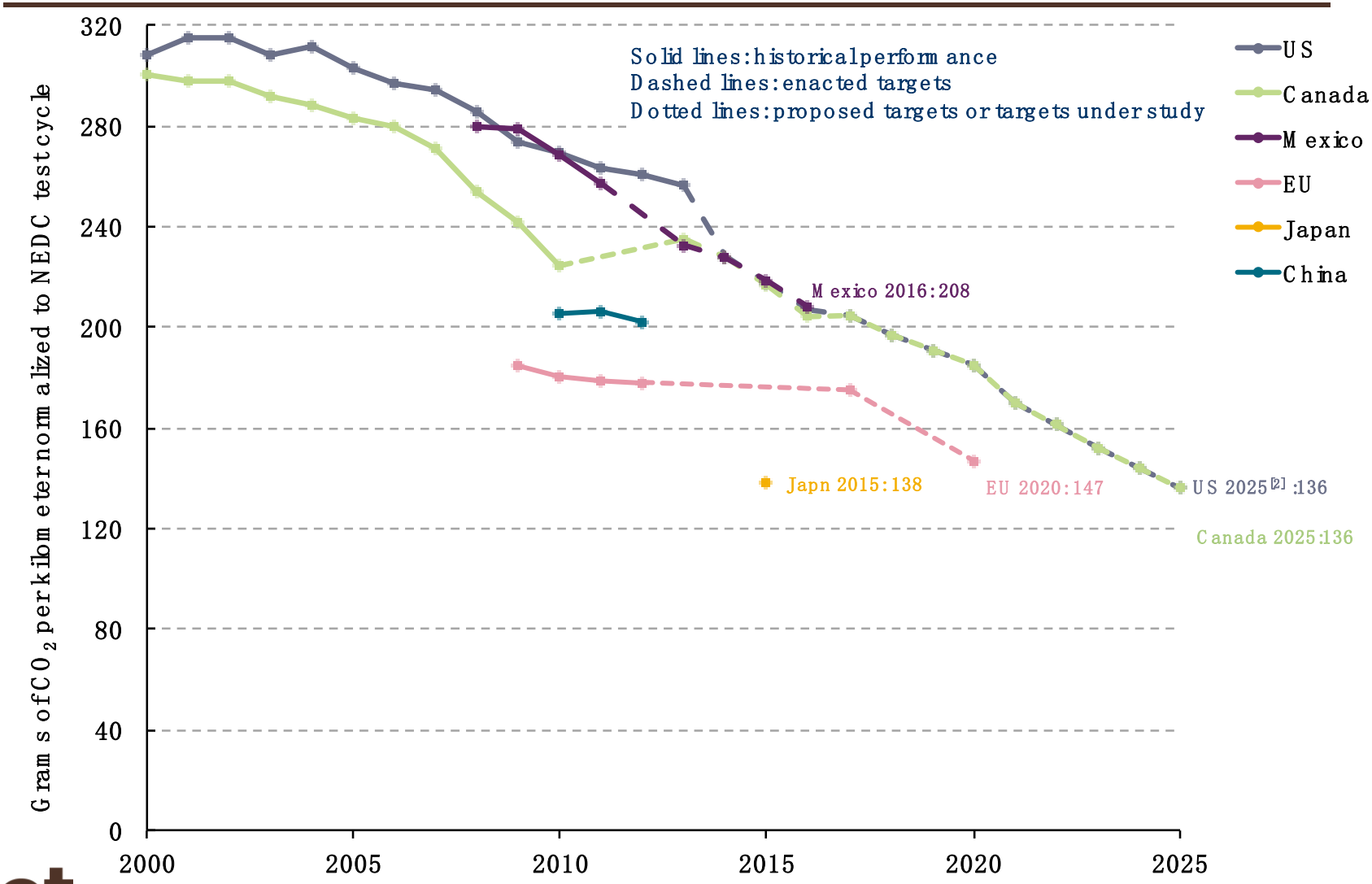
Overview of Regulation Specifications for Light-commercial Vehicle
轻型商用车具体政策概览

Country or Region	Target Year	Standard Type	Unadjusted Fleet Target/Measure	Structure	Test Cycle
EU	2017 2020	CO_2	175 gCO_2/km 147 gCO_2/km	Weight-based corporate average	NEDC
U.S.	2016 2025	Fuel economy/ GHG	28.8 mpg[i] or 298 gCO_2/mi 40.3 mpg[ii] or 203 gCO_2/mi	FP-based corporate avg.	U.S. combined
Canada	2016 2025 (proposed)	GHG	293 gCO_2/mi N/A[iv]	FP-based corporate avg.	U.S. combined
Japan	2015	Fuel economy	15.2 km/L	Transmission, vehicle structure, weight-class based corporate avg.	JC08
Mexico	2016	Fuel economy/GHG	29.7 mpg or 185 g/km	FP-based corporate avg.	U.S. combined

[i] Assumes manufacturers fully use A/C credit
[ii] Proposed CAFE standard by NHTSA. It is equivalent to 163g/mi plus CO2 credits for using low-GWP A/C refrigerants.
[iii] In April 2010, Canada announced a target for light-duty vehicle fleet of 246 g/mi for MY2016. The separated targets for car and light truck fleet are estimated by ICCT based on the overall target.
[iv] Canada follows the US standards in the proposal, but the final target value would be based on the projected fleet footprints.
FP: footprint

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

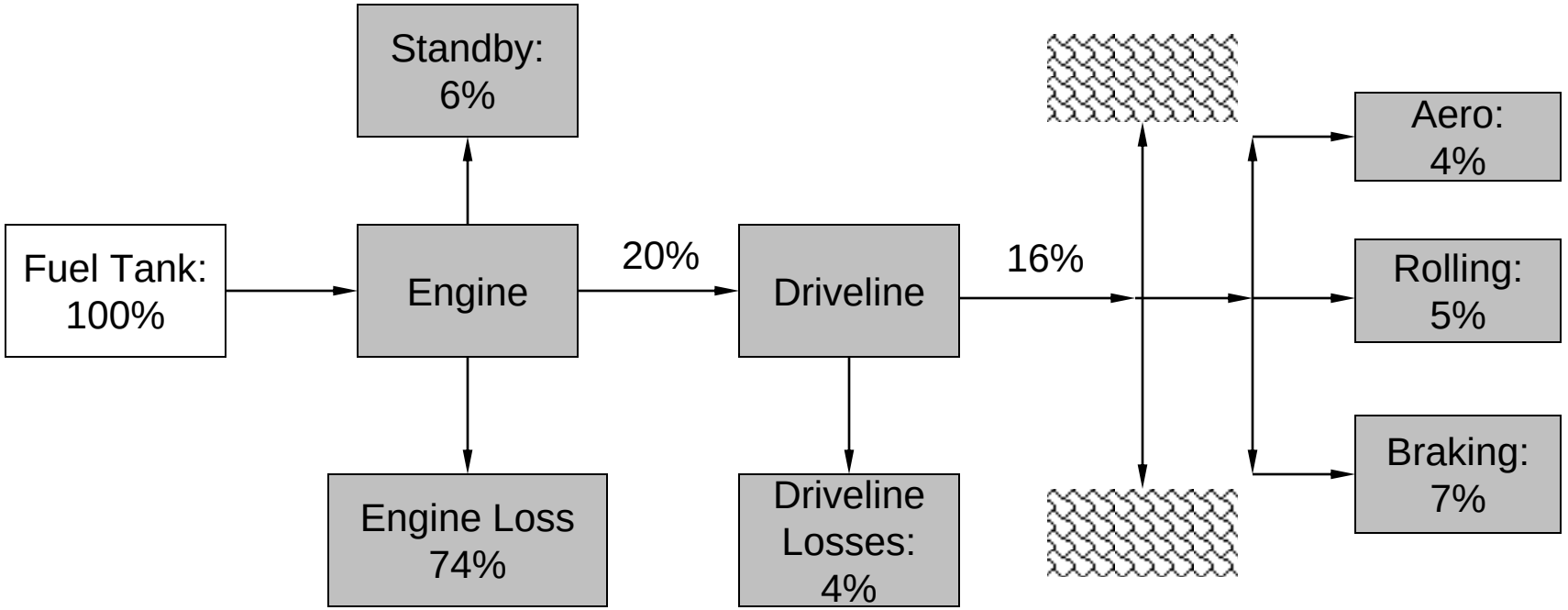
Light Commercial Vehicle Fuel Economy Standards Globally
全球轻型商用车燃油经济性标准



[1] China's target reflects gasoline vehicles only. The target may be higher after new energy vehicles are considered.
[2] US standards GHG standards set by EPA, which is slightly different from fuel economy stadards due to low-GWP refrigerant credits.
[3] Supporting data can be found at: http://www.theicct.org/info-tools/global-passenger-vehicle-standards.

Technology Deployment Spurred by Fuel Economy Standards
燃油经济性标准激励下的技术发展

Opportunities for Vehicle Efficiency Improvements
机动车效率提升机会



» Matt Kromer

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Urban Drive Cycle, 2005 2.5L Toyota Camry

A broad suite of cost-effective technology packages are available to meet upcoming efficiency standards
有多种具有经济效益性的技术可以帮助达到未来油耗标准

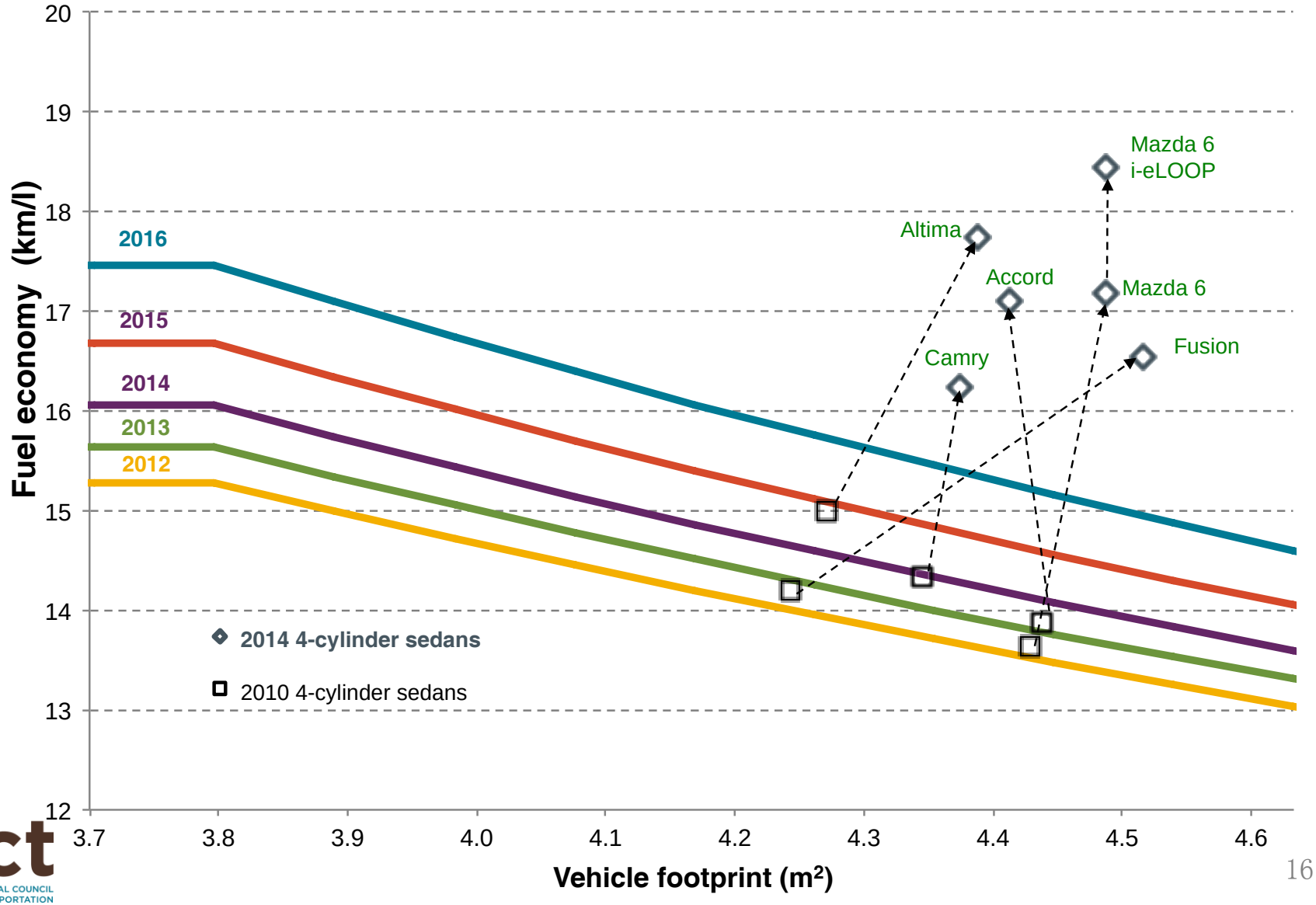
- Assessment of US 2012-2025 standards indicates the standards can be met with: 美国2012-2025年标准的评估支持可以使用以下技术实现达标
  - Gasoline direct injection (GDI) 汽油直接喷射
  - Turbocharged/downsized engines 涡轮增压/缩小发动机
  - Advanced transmissions (6-speed/8-speed automatic or dual-clutch transmissions and high efficiency gear box) 先进传动系统(6速/8速自动或双离合变速，高效齿轮箱)
  - Vehicle mass reduction 机动车减重
  - Lower tire rolling resistance 低轮胎滚动阻力
  - Improved aerodynamics 提高空气动力
  - Friction reduction 摩擦减少
  - More efficient vehicle accessories 更多提高机动车效率附件
  - Engine start-stop systems 发动机起停系统
  - …..
  - …..
  - Some increased hybrids, EVs, PHEVs 更多混合动力、电动汽车、插电缓和动力

- No penetration of diesels or hybrid vehicles necessary to meet US 2016 standards. 达到美国2016年目标不需要柴油车或混合动力车的引入

- EPA/NHTSA project that MY2025 vehicles will be 90% advanced gasoline, 9% hybrids, and 1% EV/PHEVs 美国EPA/NHTS预测2025年的车队组成为90%汽油车9%柴油车和1%电动车/插电混动

Example of Technology Upgrade: High-Selling Passenger Cars 2010 to 2014

技术升级举例：2010至2014年高销量乘用车



Accelerating Technology Introduction in the U.S. is driven by Fuel Economy Regulation

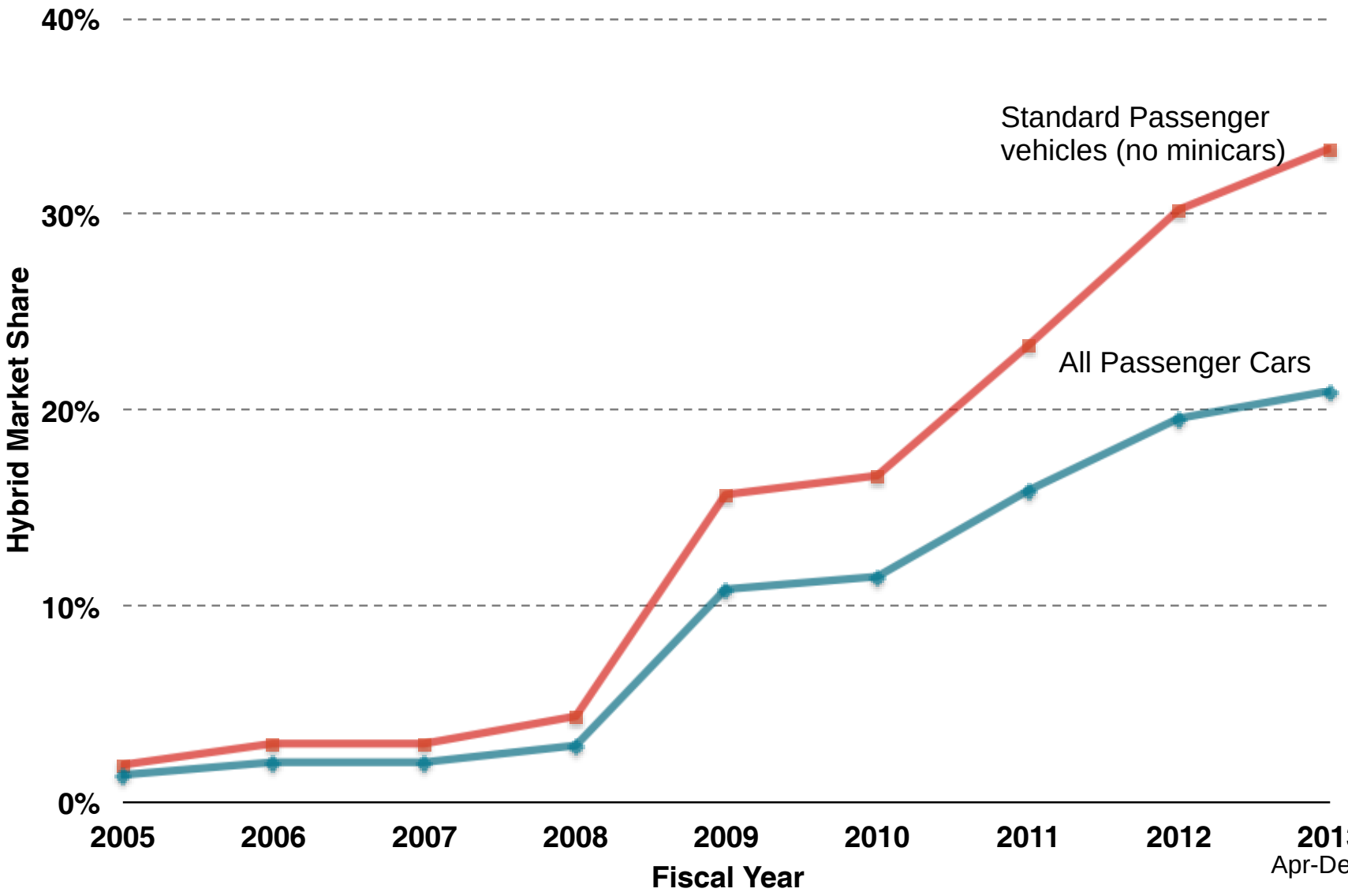
燃油经济性标准加速美国的技术引入

	GDI	Turbo	VVT	6 speed	7+ speed	CVT	Hybrid
2004	-	4%	43.7%	5%	0.4%	2%	1%
2005	-	2%	49.4%	6%	0.4%	3%	2%
2006	-	3%	58.2%	12%	2%	3%	2%
2007	-	4%	63.3%	16%	2%	10%	3%
2008	3%	4%	62.7%	19%	3%	11%	3%
2009	4%	4%	79.1%	19%	3%	11%	3%
2010	9%	4%	91.8%	33%	3%	14%	5%
2011	18%	8%	94.9%	54%	5%	12%	3%
2012	28%	10%	97.7%	58%	6%	15%	5%
2013	38%	16%	98.0%	61%	8%	17%	6%

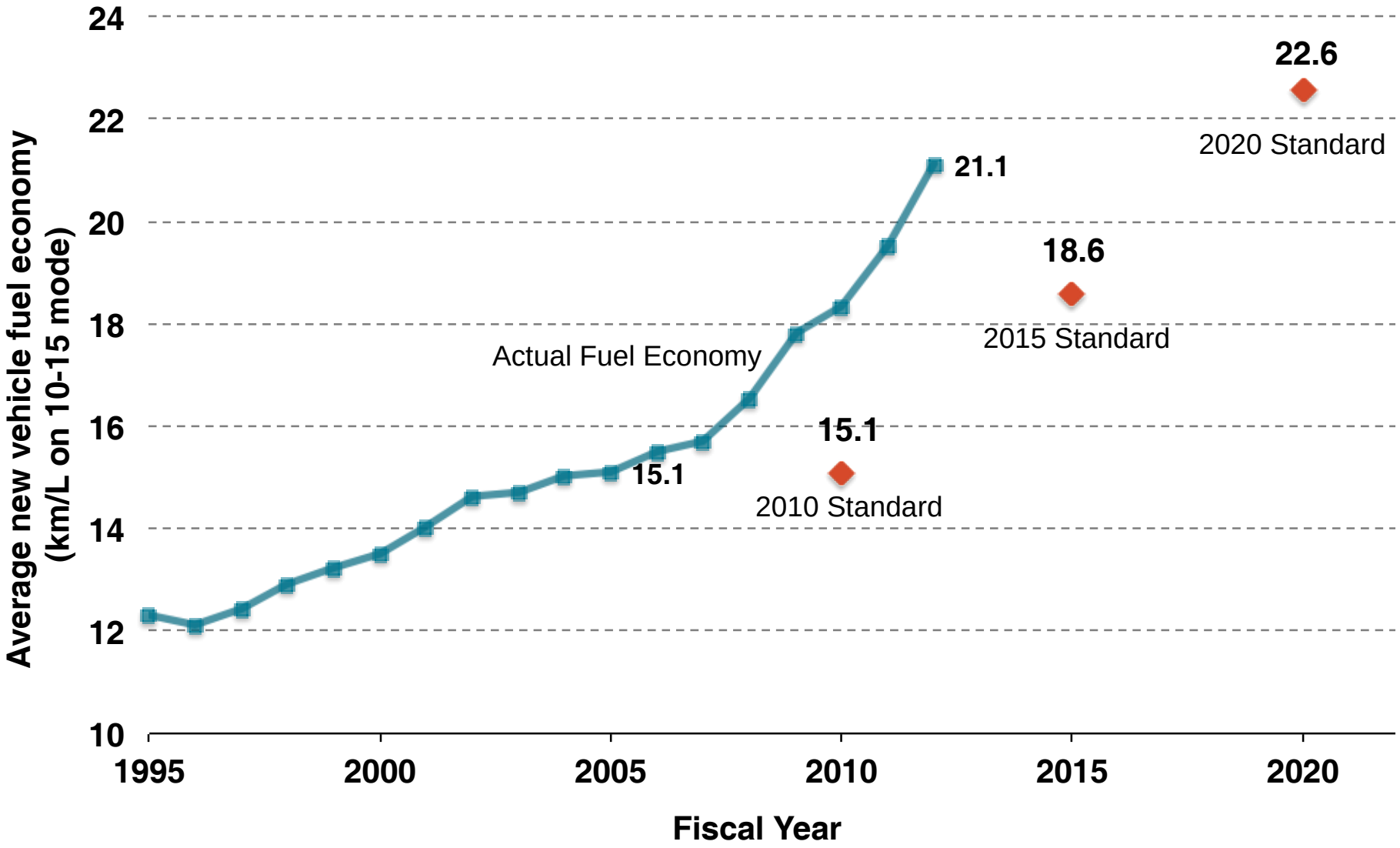
icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Source: 2013 EPA Fuel Economy Trends Report – **Cars only**
GDI: Gasoline Direct Injection
CVT: Continuously Variable Transmission
VVT: Variable Valve Timing

Hybrid Vehicle Market Share in Japan…
日本混合动力车的市场份额…

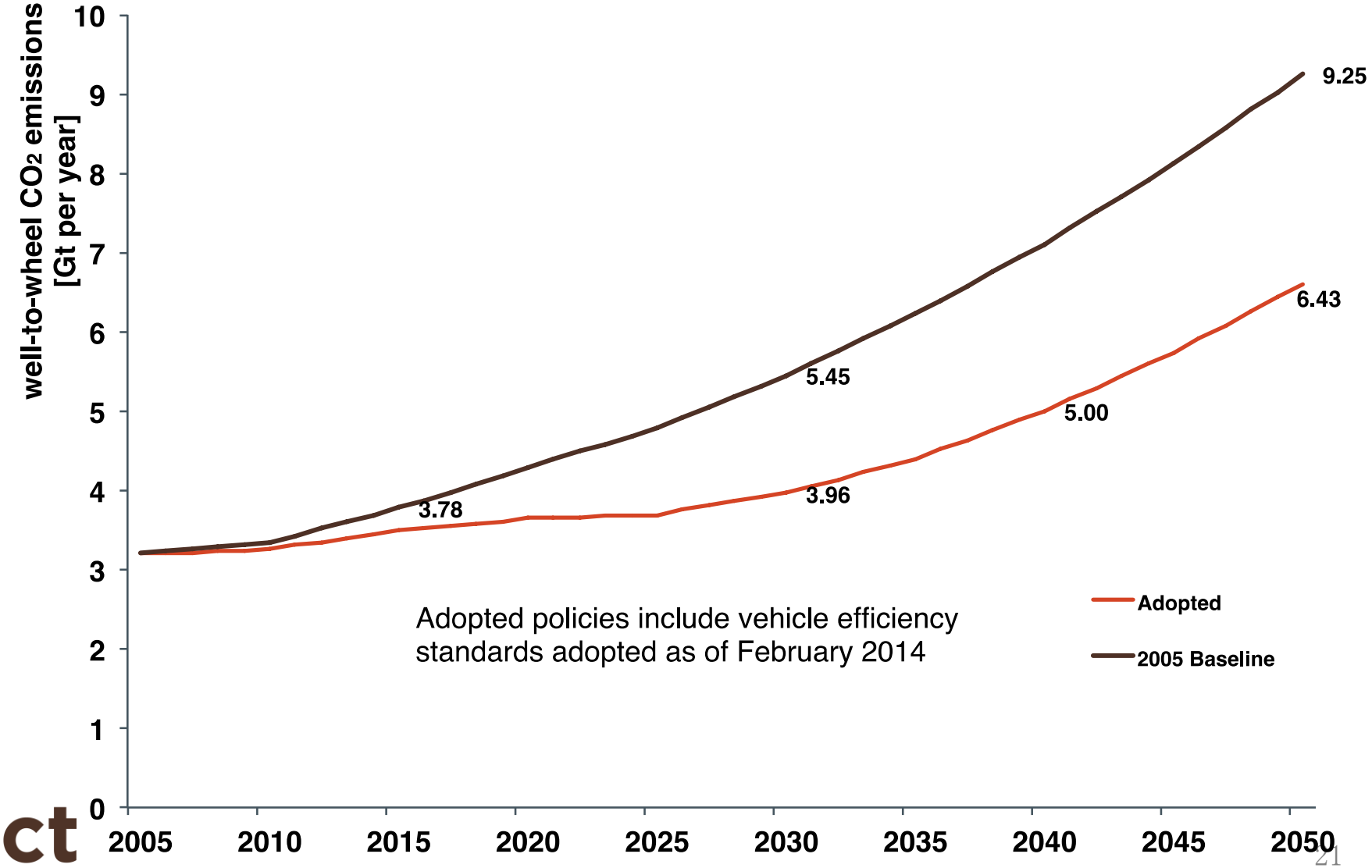


…helping Japan meet 2020 standard early
…帮助日本提前达到2020年目标



Conclusion
结论

Adopted Fuel Economy Standards having a major impact on Light-vehicle GHG emissions
燃油经济性标准对轻型车GHG排放有很大影响



Source: ICCT Roadmap Model

Vehicle Fuel Efficiency Initiatives gaining traction globally
提高机动车燃油经济性行动在全球范围内加速

- First phase of standards 2010-2020 being deployed globally.

  全球已经部署了2010至2020年第一阶段的标准

  - Attention must now be given to a post-2020 roadmap as well. 当前需要关注2020年后的战略部署

- Cost-effective technologies to meet the fuel economy standards already being deployed in large numbers around the world.

  用于达标的具有经济效益的技术已经在全世界大量展开

  - China will be able to take advantage of learning and economies of scale along the way. 中国可以学习好的经验并利用已成形的规模经济来节约成本

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

For more information… 更多信息…

- ICCT Passenger Vehicles website: http://www.theicct.org/passenger-vehicles
- Global Passenger Vehicle Standards Update: http://www.theicct.org/global-passenger-vehicle-standards-update
- US CAFE Standards: http://www.theicct.org/policies/us-cafe-standards
- EU LDV CO2 Regulation: http://www.theicct.org/policies/eu-light-duty-vehicle-co2-regulation
- Review and Comparative Analysis of Fiscal Policies to promote fuel economy:
- http://www.theicct.org/review-and-comparative-analysis-fiscal-policies
- CO_2 Standards: http://www.theicct.org/issues/co2-standards

Drew Kodjak
drew “at” theicct.org

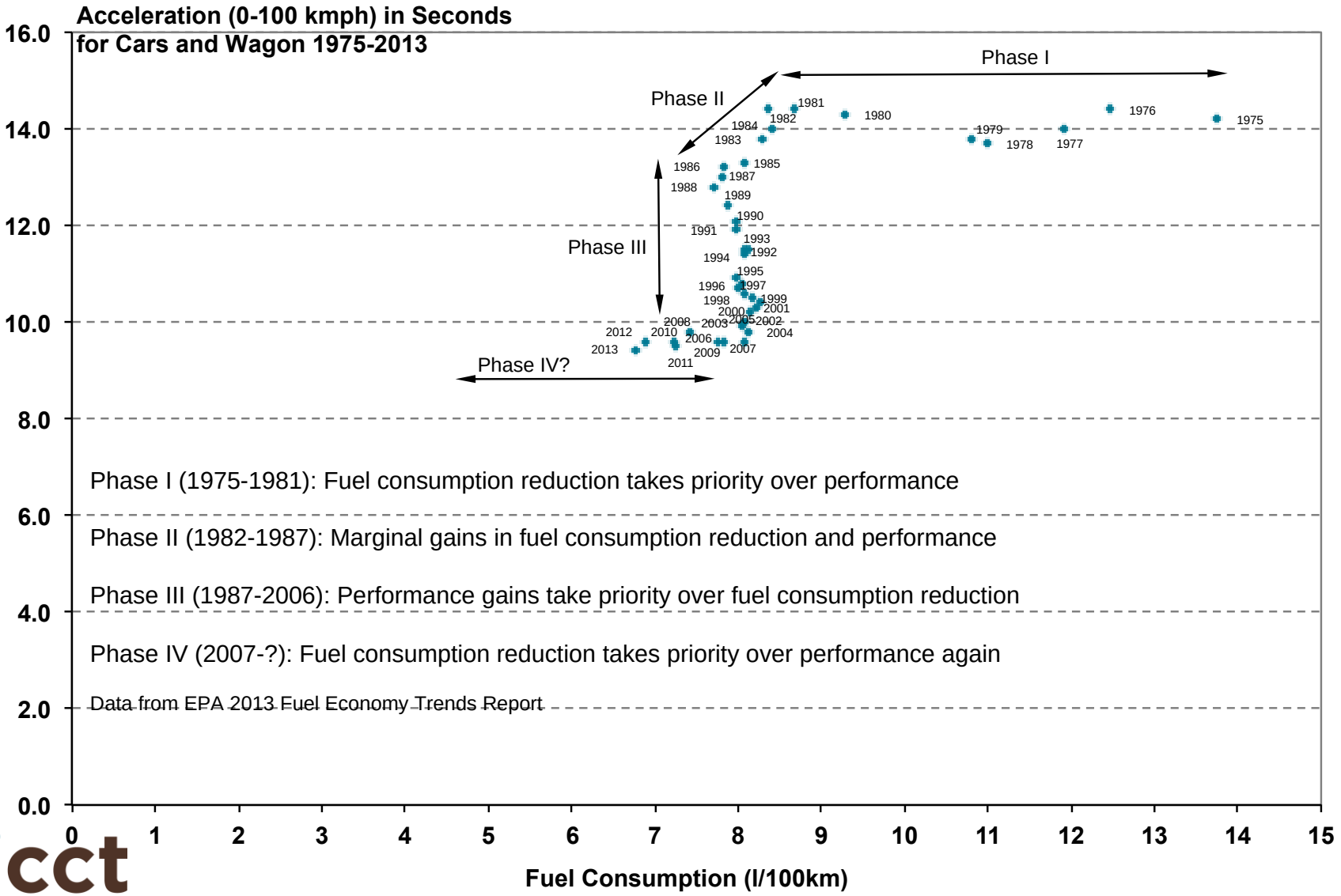
Anup Bandivadekar
anup “at” theicct.org

@TheICCT

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Role of Fuel Economy Standards in Managing Performance – Fuel Consumption Tradeoff: US Example

燃油经济性标准在性能-油耗权衡中的角色：以美国为例



icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION